VOL. XC. No. 2324. [All Rights Reserved.] JUNE 9, 1922. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] PRICE SIXPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4. SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
Telegraphic Address: "Ageekay, Cent., London." A B C Code. Telephone Nos.: Central 8260 and 8261.

LITHOLITE INSULATORS, Ltd.
55—57, Hackney Grove, London, E. 8.
'Phone and Telegrams: Dalston, 592, London.
FIREPROOF AND OTHER GRADES.
ESTABLISHED 20 YEARS.

ELECTRIC INSULATION
NON-HYGROSCOPIC & FIREPROOF.
SILUMINITE
SHEET and MOULDINGS.
'Phone — Southall 59.
THE SILUMINITE INSULATOR Co., Ltd., The Green, Southall, Middlesex.
See Large Advt. p. xvi.

FERGUSON, PAILIN, LIMITED.
Switchboards
'Phone: OPENSHAW 329 (P. B. Exchange). Hr. OPENSHAW, MANCHESTER.

INSTRUMENTS, CIRCUIT-BREAKERS, AUTO-CUT-IN & CUT-OUTS
THE Record Electrical Co., Ltd.
BROADHEATH, MANCHESTER.
TELEPHONE: 164 ALTRINCHAM.

Electric Fires, Boiling Rings, Immersers, Grills, Etc.
"HEATRAE"
Our Catalogue will interest you
ELECTRIC FIRES, LTD., NORWICH.

SWITCHGEAR.
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors.
GREENLAND PLACE, CAMDEN TOWN, LONDON.

"CANTIE"
IRONCLAD SWITCHBOARDS
CHEAP, EFFICIENT, ROBUST.
CANTIE SWITCH CO., LTD., LEIGHTON ST. - NOTTINGHAM

THE SAXONIA ELECTRICAL WIRE CO., LTD.
GREENWICH, S.E. 10.
Manufacturers of CORDS and FLEXIBLE CABLES.

CHURTON SINGLE and POLYPHASE MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS

Cutting
Electric Motors
CUTTING BROS., LTD., STAMFORD.
Telegrams: Cutting, Stamford. Tel. No. 12.

"EMPIRE"
AUTOMATIC CONTROL
FOR
Pumps, Compressors, Machine Tools.
ELECTRIC CONTROL, LIMITED, GLASGOW.

WESTERN-ELECTRIC COMPANY, LIMITED,
Norfolk House, Victoria Embankment, W.C.
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement this week, p. xiii.

CONNOLLY'S (BLACKLEY), Ld.
for
WIRES AND CABLES.
See Advertisement last week, page iii.

"L.W." DYNAMOS & MOTORS.
Manufactured by
TODMAN, RYALL & Co., Ltd.,
Head Office:—38, Grosvenor Gardens, LONDON, S.W. 1.
See Advertisement last week, page xxxiii.

E. DAWSON & CO.,
FOR LAMPS.
Osram, Mazda, Royal Ediswan, Siemens, Britannia, &c.
10, Gray's Inn Road, London, W.C. 1.
'Phone: Holborn 2794),
and 13, North John Street, LIVERPOOL.

JULIUS SAX
FOR
ACCESSORIES.
Over 50 years' experience.

SOLD.
See Sup. 9.

MOTORS
BY
McClure & Whitfield.
Small Power Dynamo Co., Ltd.
Agents
CITY ELECTRICAL CO., 1, Emerald Street, LONDON, W.C. 1.
See Advert. last week, p. xxix.

FULLER'S UNITED ELECTRIC WORKS, LIMITED.
MANUFACTURERS OF
ACCUMULATORS BATTERIES
WIRES & CABLES CARBONS, &c.
WORKS: CHADWELL HEATH, ESSEX.
General Sales Offices:
IDDESLEIGH HOUSE, Caxton St., Westminster.
'Grams: Blocbat, Vic. London. Phone: Victoria 6863.

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

ALUMINIUM for FIELD COILS.
British Aluminium Co., Ltd., 109, Queen Victoria St., London.

BIRKBY'S "ELO" INSULATION
MOULDINGS, MOULDING POWDERS & VARNISH.
ENGLISH MADE THROUGHOUT.
FLEMING, BIRKBY & GOODALL, Ltd., Liversedge, Yorkshire.

THE LEA COAL METER
keeps a complete check upon your coal consumption. It is a continuous, automatic and reliable machine for measuring your coal, just as it is burned.
The LEA RECORDER Co., Ltd., 28, Deansgate, MANCHESTER.

A Contractor's Slogan.
Every job, in every way, better and better.
Use M.E.M. Switch Gear and make sure of it. See p. xi.

Advertisement Index, see page xl.

Costs little for fuel & less for attendance.

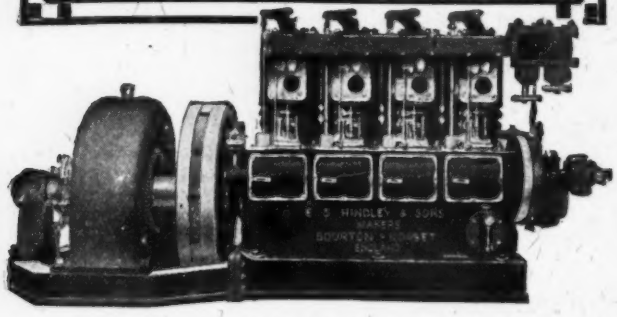
One of the outstanding features of the Hindley Vertical Gas Engine is its low fuel consumption. This, coupled with its simplicity, easy starting and absolute reliability makes it an ideal prime-mover for Works and Central Station Electric Light and Power plants.

Owing to the close governing and automatic lubrication the

Hindley
VERTICAL GAS ENGINE

will run for long periods without attention.

We make sizes up to 500 H.P. and will be glad to hear your requirements.

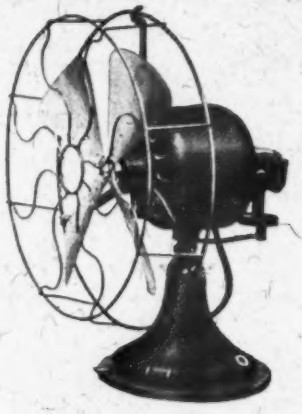


We also supply Suction Gas Producers suitable for anthracite, coke, charcoal, wood refuse and other fuels.

E. S. HINDLEY & SONS,
11, Queen Victoria Street, LONDON, E.C. 4.
WORKS: BOURTON, DORSET.

FANS
FOR ALL PURPOSES.

DESK, OSCILLATING, CEILING, SHIP, PORTHOLE & EXHAUST.



S. G. LEACH & Co., Ltd.
26-30, ARTILLERY LANE,
'PHONE: 3840 LONDON WALL. 4 lines.
LONDON, E.C.

MICA & MICANITE
INSULATORS FOR EVERY DESCRIPTION OF ELECTRICAL WORK
Contractors for Air Board, War Office and Admiralty Requirements.
CUTTING AND GAUGING OUR SPECIALITY.
BEST QUALITY MICA ONLY.

'PHONE—4575 CENTRAL.
TELEGRAMS—"MICAYLOR, LONDON."
TAYLOR & PETTERS, LTD.,
40, HATTON GARDEN,
LONDON, E.C. 1.
(The Oldest Established Mica House in the country.)
AND ALL BRITISH.

BUYERS OF SCRAP METAL Ltd.
GLYN STREET, VAUXHALL LONDON, S.E.11.
Offer your stocks
State full description and quantity
Terms of Purchase PROMPT CASH
against delivery
Telephone: HOP 4520
Telegrams: "SCRAPVAU LONDON

TRANSFORMERS
TO 500 K.V.A.
G. HANCHETT, BARRATT & CO.,
TRANSFORMER MANUFACTURERS,
ESTABLISHED 1906.
PENDLETON, MANCHESTER.

THE
ELECTRICAL REVIEW.

VOL. XC. JUNE 9, 1922. No. 2,324.

ELECTRICAL REVIEW.

Vol. XC.] CONTENTS: June 9th, 1922. [No. 2,324.

	Page
The I.E.E. Summer Convention...	793
The German Export Trade	794
Advice to Those about to Trade in India	794
A Call for Brevity	794
German Reparation Offers and Deliveries	794
The Institution of Electrical Engineers (*illus.*)	795
Some Notes on the Operation of Rotary Converters (*illus.*) ...	797
Casual Remarks from the Indian Coalfields, by A. C. Croskell	798
Power Supply for the South-Eastern and Chatham Railway...	799
New Electrical Devices, Fittings and Plant (*illus.*)	801
Correspondence—	
Turbines as Pressure Reducers	802
Electric Furnaces	802
Reconstruction and Foreign Trade	802
Fault Localisation	803
State Salary Required	803
Reviews	803
Business Notes	805
Notes...	811
City Notes	815
Stocks and Shares	818
Electrical Supplies in South America, by Percy F. Martin ...	819
The Electrical Situation in India	820
Electric Light for the Small Town, by J. M. C. Field... ...	821
Belgium's Rapid Recovery	822
Transmission-line Tests at 280,000 Volts, by R. J. C. Wood (*illus.*)	823
Short-wave Directional Wireless Telegraphy, by C. S. Franklin	824
Overload Inverse-time-limit Relay with a Definite Adjustable Minimum (*illus.*)	825
The View Park Colliery Explosion	826
Parliamentary Notes	827
Legal...	827
New Patents	828
Published Specifications	828
Contractors' Column ... ... Advertisement page xxviii	

"ELECTRICAL REVIEW" SUBSCRIPTION RATES.

UNITED KINGDOM	£1	14	8	per annum.
CANADA	1	12	6	do.
COLONIAL and FOREIGN ...	2	1	6	do.

Postage Free.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 6d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE, 4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: Central 4900 and 4901.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 392.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon and Gotch, Cimitiere Street
MELBOURNE: Peter G. Tait, 90, William Street, Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 8, Warren Street.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Ditta P. Maglione & C. Strini, 98, Via Due Macelli.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt St.
TOKYO: Maruzen Co., Ltd., 11-16, Nihonbashi-Tori-Sanchome.
TORONTO, ONT.: Wm. Dawson and Sons, Ltd., Manning Chambers; Gordon & Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW LIMITED, and crossed "London Joint City and Midland Bank, Newgate Street Branch."

THE I.E.E. SUMMER CONVENTION.

THE second post-war summer meeting of members of the Institution of Electrical Engineers at the Scottish Centre concluded on Friday evening last week, being voted by one and all of the participants an unqualified success. It was said that the popularity of the South Wales meeting two years ago was undoubtedly largely due to the wise decision to avoid in the programme anything in the nature of formal meetings, and thereby afford an opportunity of devoting the whole time to the development of the purely social aspects of the trip. This year, however, neither the business nor the social aspect was neglected, and the presence of so many ladies in the party was a particularly appreciated feature.

Everything favoured the event; the weather could not have been better, and well-balanced organisation carried the project through almost without a hitch. Only those who have been concerned in the planning and carrying out of similar arrangements can have any idea of the time that needs to be spent and the amount of unobtrusive hard work that has to be done to ensure the success of such an outing. All those responsible for this year's programme, and particularly Mr. Joseph Taylor, hon. secretary and treasurer of the Scottish Centre, deserve congratulation on the success with which their efforts were crowned.

Those who bewailed the smallness of the number of participants in the South Wales and Monmouthshire trip had no cause for complaint this year, and should similar meetings become annual events in the activities of the Institution, as they bid fair to do, it may be advisable to set a limit on their size—too large a party is apt to become unwieldy when travelling.

With a group of moderate dimensions are associated more sociability and comfort, and opportunity is afforded for all its members to become acquainted with one another: friendships formed under such congenial circumstances are of the best and most lasting. Functions of this sort play an important part in the lives of engineers; they provide opportunities for the younger men to come into contact with their seniors on a plane of social equality, which is not possible in their everyday course of business. Moreover, they permit informal exchange of opinion on current topics of the day to be carried on in a way that should be of the greatest possible benefit to all concerned.

The case for a great National Convention of the whole of the electrical associations in the kingdom, which we have often advocated, and which was so cordially supported by Major H. Richardson last year in his presidential address to the I.M.E.A., stands on a different footing. Such a Convention, like the British Association's annual assembly, would be held at one centre, and no question of travelling facilities would arise. As we said nearly a year ago, it would afford to the whole of the industry a unique opportunity for meeting everybody and discussing everything in the electrical field, and we were glad to notice in the recent report of the Council of the Institution that the suggestion had met with its approval, and might perhaps be brought to fruition next year.

A feature of the Convention was the West Highland excursion, on which journey vistas of Highland scenery that are among the finest in all broad Scotland were revealed to all who embarked on it. Not the least interesting part of the varied itinerary was the opportunity given of witnessing examples showing how the water-power resources of the Scottish Highlands can be utilised, and much power that is at present being wasted can be

conserved. Hitherto the importance of water-power development has not been sufficiently appreciated in this country, and many schemes that have been projected have met with such fierce opposition, even from public sentiment, that they have had to be abandoned.

Although these islands are not abundantly blessed so far as potential water-power resources are concerned, we have a certain amount, which would, if developed, afford a considerable measure of relief to the continually increasing dearness of coal and growing scarcity of fuel. Dr. Magnus Maclean estimates that the water potentialities in Scotland are capable of yielding considerably over half a million horse-power, which would mean a saving of many million tons of coal per year. Water-power production is many times more efficient than power produced from coal—at least 90 per cent. efficiency can be obtained from the amount of water passing through a turbine, against 20 per cent. from coal. Moreover, the saving in man-power by producing energy from water power, as compared with steam power, is large, especially if the number of men required to mine the coal and transport it about the country is considered.

Water power is the greatest asset a nation can possess, and any scheme, tidal or otherwise, that is capable of being commercially developed, even at what may appear to be a great initial cost, should receive most careful consideration so that the community may utilise the gifts of nature, now running to waste, and thus relieve the ever-increasing difficulties of our coal supply.

The German Export Trade.

Dealing with export questions before the recent general meeting of the Central Union of the German Electrotechnical Industry at Wurzburg, Herr Brandt stated that export prices were kept considerably higher than the German inland prices through the control exercised by the Foreign Trade Bureau and the action of the price department of the Central Union. The exports, which in 1921 represented in quantity from 50 to 60 per cent. of the exports in 1913, were not increasing, although the world's requirements and manufacturing had considerably increased in the meantime. The United States was now producing from 50 to 60 per cent. more than in former peace times and the productive capacity of that country had been doubled. Large increases in the output capacity had also taken place in England, France, and Switzerland, while other countries, Spain, for instance, had built up an electrical industry. In conclusion, the speaker remarked that competitors had grown and the difficulties were considerable, but the difference in prices was no longer so great as to permit Germany to secure the orders through this difference.

Advice to Those about to Trade in India.

Electrical men who are studying the foreign trade situation and are anxious to profit from the advice of a man of ripe experience in India will do well to read carefully some information received from one of our Special Correspondents and published on another page to-day. In reviewing the electrical situation there, he discusses the changes that are taking place, pointing out that though Japan had things all her own way during the war, the market is now shifting back again towards the West, though not entirely to England. Germany is naturally resuming her former activity, and the attention of the British manufacturer and of the British workman is directed to the effect that price will almost inevitably have upon the course of business, notwithstanding the war-time expression of pious determinations against trading with a people whose ill-deeds made them infamous. Another point whereon our Correspondent's lengthy experience is of inestimable value is the avoidance of indiscretions by travellers new to the Indian market. The man who is out for orders must be above all discreet and tactful, willing to conform to the rules of the business houses whatever may be his personal opinion regarding those rules. It is useless to imagine that houses that have been established for many years and have adopted particular ways of conducting their operations will alter those ways for a newcomer without some very special reason. This is but one of the many pieces of good counsel that go to make up the complete guide required by the man who means to seriously study a market with a view to approaching its buyers aright and by the manufacturer who seriously intends to make the articles that a market requires rather than to try to pass off upon it the type of article that he makes. Here and there the foreign buyer may be waiting on his doorstep to receive the British salesman or traveller, but, generally speaking, it would be unwise to lay out plans for a lightning tour. Frequently enough the traveller will have to wait for the potential purchaser's convenience if he means to have an interview, and sometimes it has paid well to wait weeks to see one man.

A Call for Brevity.

Under the Electricity Supply Act, 1919, the Electricity Commissioners, after they have delimited a district, hold an inquiry into schemes for the reorganisation of the electricity supply in that district. The Commissioners then take these schemes and revise them, or replace them by one of their own, as they think fit. After this the Commissioners have to publish their approved scheme and hold another local inquiry. Now, out of the 15 districts delimited, a good many of the first inquiries have been held, but no second inquiry has yet taken place. It is to be hoped that when these second inquiries are held the Commissioners will find some method of cutting them down to the shortest possible limit. It will be remembered that the London and Home Counties Inquiry lasted over 26 days, and covered over 12,000 questions, not to count counsels' speeches and interpolated explanations. We trust that when the second inquiry for London comes along there will be some limit fixed to loquacity. We are reminded of all this by seeing that the Commissioners recently issued a draft Order under which they may apportion the expenses of an inquiry between the various parties and in such proportions as they think fit. The Commissioners would be conferring a benefit on the public if they could use these powers as a rod of castigation on those who insist on appearing at the inquiries as obstructionists or merely to cross swords over ancient feuds. If the Commissioners could recover their expenses at the inquiries by imposing fines on irrelevancies and suchlike they would, while filling their coffers, at the same time confer an inestimable benefit on everybody concerned in the inquiry.

German Reparation Offers and Deliveries.

Some light on this question was thrown by Herr Busse in the course of a report placed before the fourth general meeting of the Central Union of the German Electrotechnical Industry, which was held at Wurzburg towards the end of May. The report stated that in connection with the agreements for reparation deliveries in kind, the German electrical industry alone made offers in 1921 which represented a milliard gold marks (£50,000,000) in lighting and power plants and a half a milliard gold marks (£25,000,000) in telephone and telegraph installations. But practically no replies were received. It was only last winter that conditions improved, and down to the present time the Germans had received orders worth a total of 312,000,000 paper marks, of which 161 millions applied to lighting and power plants, 111 millions to cables, and the remainder to telephone and telegraph installations. Of these orders only 2,500,000 marks devolve upon France, 25,000,000 on Italy, 66,000,000 on Belgium (telephone and telegraph articles only), and 117,000,000 marks on Jugo-Slavia. All these orders are exclusively for State purposes, and, with the exception of Serbia, no contract has been placed with German works for private account.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

SUMMER CONVENTION IN SCOTLAND.

(*Continued from p.* 763.)

For the afternoon of the first day of the Convention, alternative attractions had been arranged: a circular excursion by motor charabancs to the Glasgow Corporation reservoirs at Milngavie, *via* Bearsden, Stockiemuir, Blanefield, &c., appealed to the majority of the visitors, whilst the smaller party was conveyed by the same means on a visit of inspection to the Clyde's Mill electric power station of the Clyde Valley Electrical Power Co., one of the largest undertakings of its kind in the kingdom.

The company was incorporated by Act of Parliament in 1901 to generate and supply electrical energy within parts of the Counties of Lanark, Renfrew, Dumbarton, and Stirling. The area of supply extends from Craigendoran and Port Glasgow on the west to Lanark and Shotts in the east, 735 square miles, along the valley of the River Clyde, and it embraces one of the most important industrial areas in the United Kingdom. In 1902, a contract was awarded for the erection and equipment of two generating stations, for the laying of a comprehensive system of distribution mains, and for the provision of a number of sub-stations. The two stations are located at Yoker and Motherwell, distant respectively about 6 and 13 miles from Glasgow; the former station stands on the right bank of the river Clyde, and is well situated for the distribution of electricity amongst the shipbuilding and engineering works lying along the river, whilst the latter station is in the heart of the steelmaking and coal mining districts — both these stations were started on commercial load in 1905. At Yoker the plant consists of two 3,000, two 5,000, and one 15,000-kW turbo-alternators, with the necessary boilers and auxiliary plant. An additional boiler house is in course of construction to accommodate six boilers, each capable of evaporating 44,000 lb. of water per hour. The Motherwell plant comprises one 3,000 and three 5,000-kW sets.

As an urgent war measure a third station to contain a 5,000-kW turbo-alternator, boilers, and other plant was completed and put into service in 1915, within a year.

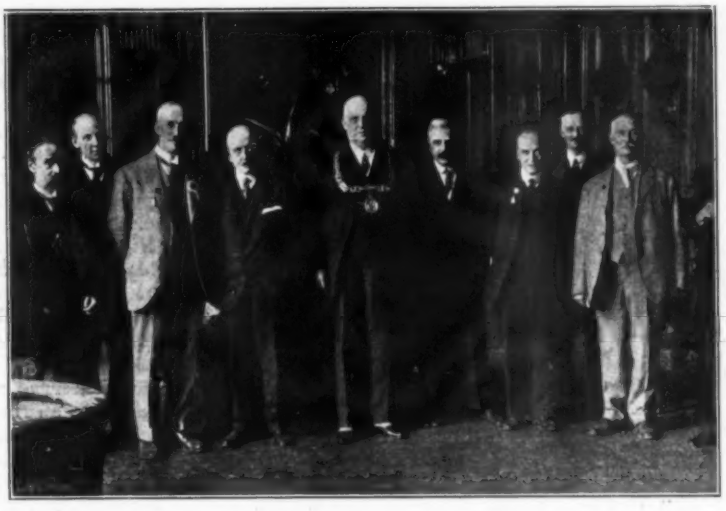
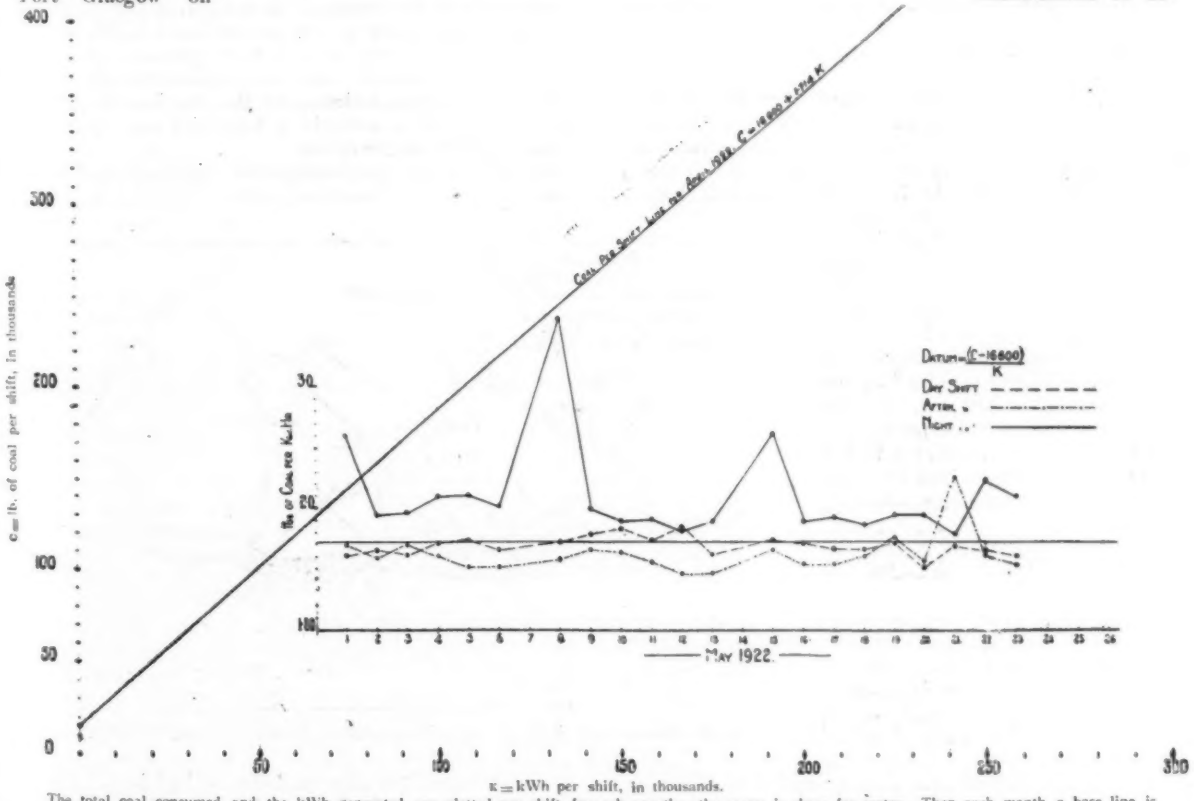


Fig. 3.—The Lord Provost and Leading Members of the I.E.E.



The total coal consumed and the kWh generated are plotted per shift for each month; the same is done for water. Then each month a base line is drawn on squared paper, which represents the coal per kWh, or water per kWh, less the station losses—that is to say, if the coal line for the previous month is c = 16,600, plus 1.714 κ, then the base line is at 1.714, and the performance of each shift is plotted against that line. If any shift result line shows a great departure from the base line, an inspection of the summary sheet should help to reveal the cause of the disparity.

Fig. 4.—"Parsons" Comparative Efficiency Diagram Obtained at Dalmarnock (see p. 762).

D

This station is situated at Cambuslang, in the County of Lanarkshire, and is built upon the left bank of the River Clyde on the site of the old Clyde's Mill, from which it takes its name. The buildings and plant have been extended from time to time (the ground taken up by the company extends to about 52 acres), and the site is admirably served by railways, over which coal may be drawn directly from the Stirlingshire, Lanarkshire, and Ayrshire coal fields. With the site the company acquired the ancient water rights pertaining to Clyde's Mill and, in addition, it has also acquired the controlling interest of the water rights on the opposite side of the river. That being so, it is entitled to utilise the whole flow of water passing down the River Clyde, and in this respect the power station occupies a unique position.

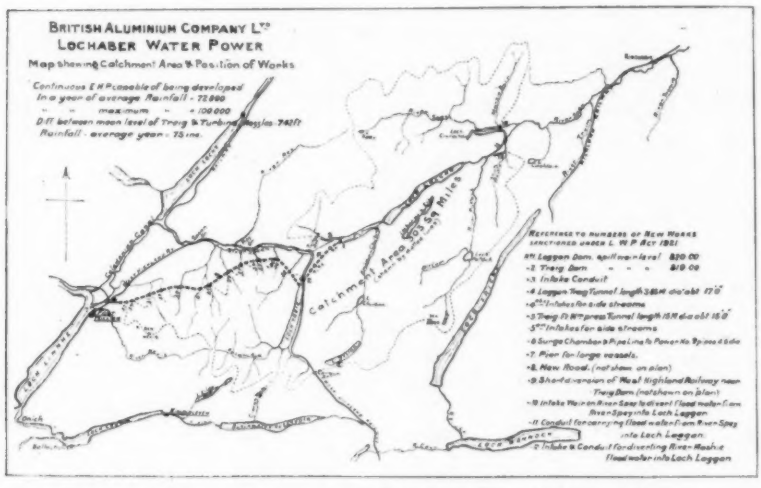

BRITISH ALUMINIUM COMPANY L.D
LOCHABER WATER POWER
Map shewing Catchment Area & Position of Works
Catchment Area 601.59 Miles

FIG. 5.—CATCHMENT AREA OF THE LOCHABER HYDRO-ELECTRIC SCHEME.

The coaling arrangement is such that the stock is carried on the ground rather than in overhead bunkers, thus eliminating the need for heavy steel structures. The fuel is delivered into a "fan" siding, and is thereafter hauled by electric locomotives that collect their energy from overhead conductors. The four-roll type crushers have a capacity of 40 tons per hour when breaking 18-in. cubes to a size that will pass through a 1¼-in. mesh. The 10 boilers are of the land water-tube type, and each is capable of evaporating 33,000 lb. of water per hour from and at 212 deg. F. The steam pressure is 200 lb. per sq. in., and the steam is superheated to 580 deg. F. The make-up feed water for the boilers is treated in a softening plant.

The turbo-generator room contains two 5,000 and one 15,000-kW sets. All the auxiliary motors are of the three-phase type, and the main switchgear is well laid out, complete phase separation being aimed at throughout. The river is dammed at the works site, and a more or less steady water level is maintained all the year round.

Three-phase, 25-cycle, a.c. is generated at 11,000 volts at all the stations, and Mr. D. Macfarlane Macleod, chief engineer to the company, reports that the output for 1920 reached 147,775,160 kWh, and that the capacity of the consumers' plant contracted for at the end of that year was 150,441 h.p. The company has about 200 sub-stations on the e.h.p. network, which has a route length of over 300 miles, including about 60 miles of overhead transmission lines. All the stations are interconnected through the 11,000-volt network, and a 33,000-volt interconnecting cable is now being laid between the Yoker and Clyde's Mill stations.

After being entertained to afternoon tea, both parties returned to Glasgow; later in the evening at the City Chambers a reception of the guests by the Lord Provost, Conveners, and members of the Tramway and Electricity Committees of the Corporation, took place, and was followed by a dance. During the evening an excellent programme of vocal music was rendered by the Glasgow Select Choir, which was highly appreciated.

On the morning of the second day of the meeting, May 31st, a visit was paid to Glasgow University, a short tramcar journey westward from the centre of the city. There in the old Kelvin lecture room, the scene of so many of Lord Kelvin's early experimental demonstrations, Principal Sir Donald MacAlister cordially welcomed the visitors to Gilmorehill. A paper on the subject of "The Hydro-electric Resources of the Scottish Highlands" was then read by Prof. Magnus Maclean, D.Sc., LL.D., &c., of the Department of Electrical Engineering, Royal Technical College, Glasgow, in the course of which he pointed out that, personally, he was concerned with water power not only as an industrial proposition, but also as a means of elevating the national life, of restoring its man power, of relieving the congestion in large centres, of resettling the people on the land, and of furnishing them with better houses, food, and clothing, and a more natural life in the country. In a word, he held that the proper use of water power in the Scottish Highlands would go far to solve some of their pressing problems and promote comfort and contentment among large sections of the population—and that the healthy life of the country would react in a beneficial way upon the higher interests of the cities.

For several past generations the Highlands had been pouring their best manhood and womanhood into the cities and towns, the glens and straths had been becoming more and more desolate, and much of the land had been going out of cultivation. It was not their wish that that race—hardy sons of the mountains—should die out owing to their land becoming desolate; it should be preserved as a bulwark of their freedom and more especially to rejuvenate the life of the nation by infusing new blood and fresh ardour into the cities.

A little industry introduced here and there throughout the Highlands, to supplement local activities and at

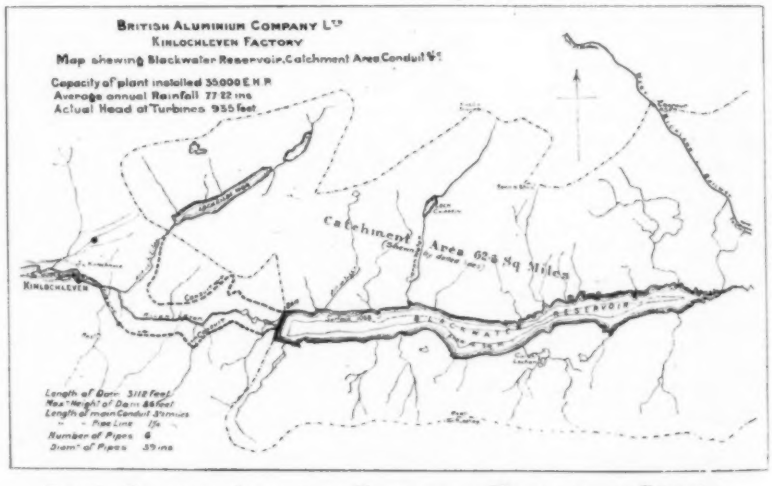

BRITISH ALUMINIUM COMPANY L.D
KINLOCHLEVEN FACTORY
Map shewing Blackwater Reservoir, Catchment Area Conduit &c
Capacity of plant installed 35000 E.H.P.
Average annual Rainfall 77.22 ins
Actual Head at Turbines 935 feet
Catchment Area 62.8 Sq Miles
KINLOCHLEVEN
BLACKWATER RESERVOIR

FIG. 6.—CATCHMENT AREA OF THE KINLOCHLEVEN HYDRO-ELECTRIC SCHEME.

the same time utilise more fully local resources, was what was needed. For that industry water power was immediately available, and was so distributed by Nature that there need be no congestion; it might be portioned out to serve wide areas of the land, and villages would thus spring up as marts and centres for the rural districts.

Hitherto, the Highlands had been severely handicapped in the matter of industrial activity by not having a coal supply of their own on an adequate scale, and the present coal shortage and dearness of fuel made it all the more important to turn to the bountiful provision of Nature by the use of which they would be no longer dependent entirely on coal for power, but might have their own railways and machinery worked by a more simple and, in the Highlands at least, more readily available natural resource. The extent of the Highlands was 40 per cent. of that of Scotland, and only 7 per cent. of the population was within that area.

"It is in territory such as this that a keen discriminating intellect is developed, and that the brawn and muscle of the British race is bred and reared, and not in congested hives of industry, and if employment can be found for such a people in their own environment it is all to the nation's interest to provide it" (Newlands).

After referring to the various reports of the Water Power Resources Committee, Dr. Maclean drew attention to some water-power schemes already in existence in the Scottish Highlands, and outlined some proposals that had materialised since he addressed members of the Institution on the subject at the Aberdeen Sub-Centre three years ago. He gave some details of the Foyers River, Loch Leven, and Kinlochleven hydro-electric power installations in connection with the production of aluminium, summarised the Lochaber and Grampian water-power schemes, and described two small installations that made use of the water of streams without reservoirs or batteries—*i.e.*, that at Inshes*, and another near the head of one of the sea lochs in Argyllshire. The electricity generated by the last two works was utilised for lighting and heating mansion houses and for driving electric motors for farming purposes; they had given complete satisfaction, and there were scores of similar Highland streams running to waste through sparsely inhabited glens and straths which could be utilised for industrial and other useful purposes at a comparatively small expense. The rainfall varied at different parts of the Highlands, but every square mile of catchment area, even in summer, would yield an average flow of 180 cu. ft. per minute, or one e.h.p. at 75 per cent. efficiency for every 3.9 ft. of fall. Thus, there existed in the Highlands considerably over half a million potential horse power in the lochs and rivers which should at once be utilised to establish suitable industries at the places where the power was available.

They were now at a point of departure in their whole industrial system; the old order, black and barbaric in many features, was yielding place to new methods. They were thus in the midst of readjustments which heralded the dawn of a new era—a better time for the world. For all practical purposes, light, heat, and power were coming more and more to be comprehended in the word "electricity," and, as their coal resources were being depleted, they must rely for its production in the future to a far greater extent on oil, water power, and other (at present undeveloped) agencies—oil and water power were already within their grasp waiting to be used. The practical part was a problem of intense interest to electrical engineers, but beyond the industrial and commercial, Prof. Maclean thought they might all claim to have some interest in the moral and spiritual aspects of the subject. At the best the getting of coal in the bowels of the earth in dark, damp, cramped, and often nauseous conditions was not exactly an ideal way of making men. In the future (and might it be in the near future) he fancied people would wonder at the "black age." In developing, therefore, the resources of Nature—such as oil, water-power, and electricity—they were helping to clean and brighten the lives of men and to deliver them from the grinding care and the black misery of the nether regions; thus raising them to a higher level of health and happiness and a higher ideal of manhood.

* Electrical Review, December 24th, 1920, p. 808.

On the motion of Mr. C. H. Wordingham, seconded by Mr. Roger T. Smith, a vote of thanks was accorded Dr. Maclean for his lecture.

Prof. Andrew Gray endorsed the hope expressed by Dr. Maclean that when power stations were established in the Highlands, and workmen were brought there, the housing arrangements made for the people would be not only good, sufficient, and comfortable, but have some pretension to elegance. The rows of houses in which pitmen were accommodated were in many places a disgrace to the Lowlands of Scotland, and he hoped that that kind of thing would not be done afresh in the Highlands.

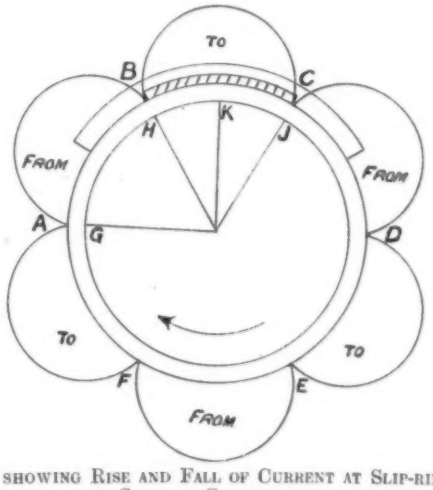
(To be concluded.)

SOME NOTES ON THE OPERATION OF ROTARY CONVERTERS.

By "ROTARY."

It is the purpose of these notes to point out some details concerning the operation of rotary converters, to sub-station superintendents and others interested in their maintenance.

As one concerned with their maintenance for a considerable while, the writer has found the greatest trouble encountered to be the flatting of the slip rings. This trouble is more pronounced in low voltage and high amperage machines, and there are cases where long hours of running at practically full load are required by the exigencies of the service to which they are applied. In most supply companies' sub-stations, however, a large load and therefore high current density will probably be carried only for a short portion of the day, and as



Sketch showing Rise and Fall of Current at Slip-rings of Six-pole Converter.

flatting is only produced when a current is flowing this trouble will not be excessive.

It has been known for some time that when current is passing from the brushes to the rings the material of the brush passes or burns away, and when the current passes from ring to brush the ring will flat.

Now, the wear on the brush is obviously not of paramount importance, whereas if some parts of the ring become flatted with respect to the remainder of the ring there will be vibration of the brushes set up and consequent sparking. One method of overcoming this would be to keep the current density between brushes and rings very low, but when large currents are required this necessarily becomes difficult. Considerations of cost do not usually permit of a greater number of rings than

six, and the width of brushes is limited by considerations of good contact, low inertia, and desirability of keeping to standard sizes.

The only way, therefore, will be to increase the number of brushes per ring or the arc covered by the brush arms, and it will now be considered how this may be done in such a way that all parts will be subjected to an equal amount of flatting.

In order to make the explanation of this easier, the foregoing sketch is used. Taking the case of a six-pole rotary converter whose supply is delivered at 50 cycles, there will be three complete cycles every revolution. Considering the case when the brush span is one-sixth the circumference of the ring, the current rises and falls, as shown between the points A, B, C, D, E, F, and, considering the centre portion of the sketch representing the ring to revolve, and taking point G as time vector for the current, it will be seen that when passing under the brush the part of the ring near the point J current will pass to the ring, when near the point K current will pass to and from the ring, and when near the point H current will pass from the ring; thus there will be three flats formed on the ring at the points where the current leaves only. If the segment covered by brushes is now extended to one-third of the circumference it will be seen that at all points of the ring currents flow both to and from it, and therefore flatting will practically vanish; that is, the brushes should enclose a span equal to a complete cycle. This has been found to be very beneficial in certain cases.

CASUAL REMARKS FROM THE INDIAN COALFIELDS.

By A. C. CROSKELL.

Punch once gave considered advice to those contemplating the bonds of holy matrimony. The same advice might safely be given to those thinking of becoming slaves of the lamp, batti-wallahs in India, for neither of the benefactors under this free gift scheme are likely to put more than a gratuitous value on it.

Think of a horse-shoe curving round from Calcutta to Nagpur in the Central Provinces and then back to the sea, some hundred miles North of Madras, and you have the coal areas of India. Imagine the nail holes to be districts where the coal is worked, and you get an idea of the scattered nature of the coalfields.

Visualise if you can coal, an out-crop, waiting only to be quarried, as millions of tons of it are around Ranchi, across the Adjai River, and in the undeveloped fields of Dalton Ganj, and then scratch your head in wonderment at the fact that but a few weeks ago a contract for several hundred thousand tons of English steam coal was placed by the Railway Board for delivery in India for use on the locomotives.

There is hardly a fiery mine in India, so that the safety lamp of the mild Hindu who raises the coal consists of a discarded cigarette tin, soldered to a long wire handle and primed with a lump of tow, that burns with much smoke. The garb of the gentle Soul that carries this lamp is even more simple; it is a costume that certainly would not pass the disapproving eye of an English Urban District Councillor, if suggested as suitable for a bathing dress. Mainly it doesn't consist, and what little there is of it would put a handkerchief to shame. His requirements, or rather theirs, are just as simple, for the wife of his bosom shares equally in his labours at the pit, whilst enjoying the additional honour of running his simple home—a one- or possibly two-roomed kind of shanty, provided in many cases by the colliery company, which, from the Santiall's point of view, is the acme of luxury.

With all these comforts to make him contented, it is strange that during the last year or two the total annual coal output for all India should have fallen from about 24 million tons to 17 million tons, when India has been enjoying what the captains of industry called her industrial renaissance and what the optimistic investors found to be still-born enterprises.

Our friend with the cigarette-tin safety lamp is responsible, amongst other causes, for this fall in output, because amongst other things, he has learnt to appreciate the advantages of direct action, and at the slightest provocation he downs tools and leaves his work. Not for him are rules that seek to regulate his hour of coming and his hour of leaving work. He scorns such things as shifts, coming and going at his own sweet will, the latter part of the journey being more to his liking than the former.

No impresario could be more doubtful of the behaviour of a petted prima donna than the colliery manager of his black labour. Having gained the rise in pay that they asked for a few months back, one by one, as it suited their convenience, they drifted back to work when the strike was over. Not a ton more coal was raised; in fact, as I have stated before, the output has fallen steadily, but the miner earns as much as he did before, which is ample for his simple requirements, consisting as they do mainly of raw grog, and he works shorter hours to earn the money to buy it. "Why worry?" says he—and he doesn't. It is the shareholder that does the worrying, whilst the colliery manager grinds his teeth, tears his hair, and thinks of appropriate answers to his managing agent's inquisitiveness, knowing that he will have to reply in that mild way which is supposed to turn away wrath.

There are three hundred million inhabitants in India, a large proportion of them beggars by profession. A gentleman passed me on the Grand Trunk Road yesterday, advancing to some holy place in frog-like leaps, and resting wherever a benevolent crowd could be expected to collect in more ways than one. Another enthusiast sometimes goes by on his cart of the soap-box *genus*, pulled by one of his friends. A liberal coating of ashes gives both the necessary odour of sanctity, and a seat of spikes moves the tender part of the crowd to charity.

Although there are so many million useless unreliable souls in India, it is almost impossible to find a man ready to undertake a job of work. In fact, you might say without fear of contradiction that there is not such a man in the whole of India. Give him bucksheesh for having salaamed you, or walk from your car to a shop in the Bazaar, and you will be surrounded by crowd of brown bodies willing to take pice without having earned it. Should you try to get your miner to come to work a little more regularly, a little more punctually, he packs up his goods and chattels in what might have been a pocket-handkerchief and goes over to Mr. Blank at the next-door colliery, who, being very short of labour, welcomes him with a gracious smile, inducts him into his new living, inquires tenderly after his family's health, and all the time wonders if his treasure will come to work next day.

My sole qualification to discuss the advantage of ample flanges in fiery mines, or advisability of single suspension for shaft cables, being my abysmal ignorance on the subject, I have left technical questions alone, for the unhappy one who may ever come to an Indian mine will find that the plant installed is much the same as at home—some of it up-to-date, some of it coeval with the first experiments of Faraday. The most interesting feature about it is the ease with which a native *mistri* can damage and put out of action armour-clad gear that looks strong enough to resist the explosion of a 12-in. shell.

The birth of a new era has just overtaken the coal-

fields, and coal-cutters have been discovered; their praise is sung in sweet American accents through the sun-baked fields of Bengal. One well-known firm from the States is willing to spend 200,000 dollars on propaganda and introductory work. If its efforts meet with the same success in the future as they have enjoyed in the past, another market will be lost to England.

American mining and Indian mining, so the experts say, have much in common. Both enjoy an immunity from Board of Trade laws, and you can pretty well earth your portable plant as you like, so long as you are not found out (and there is no one to find you out), or so long as no one is killed, for however much our black brother asks to be electrocuted, by his inquisitiveness, since the days of Mr. Gandhi, now happily in gaol, he is not allowed quite so free a hand in his research work as once he was.

POWER SUPPLY FOR THE SOUTH-EASTERN & CHATHAM RAILWAY.

Electricity Commissioners' Inquiry.

The Electricity Commissioners, on Tuesday, May 30th, began an inquiry into applications by the Managing Committee of the South-Eastern & Chatham Railway Co. for permission to build a new power station at Charlton, and by the West Kent Electricity Co. to build a power station at Belvedere. Sir John Snell presided.

Counsel appearing were as follows: Managing Committee of the South-Eastern & Chatham Railway, the South-Eastern Railway Co., and the Chatham & Dover Railway Co., Mr. Clode, K.C., Mr. Miller and Mr. Tyler; County of London Electric Supply Co., the Hon. Evan Charteris, K.C.; the West Kent Electricity Co., Mr. Tyldesley Jones, K.C., and Mr. Harker; the London County Council, Mr. Henderson, K.C.; London Electricity Supply Joint Committee, Mr. Kennedy; Conference of Local Authorities, Mr. Turner and Mr. Hodgson; London & South-Western Railway Co., Mr. W. Bishop. Other parties represented were the Port of London Authority and the British Petroleum Co.

Mr. Clode said the proposal of the Managing Committee of the South-Eastern & Chatham Railway was to erect a generating station on a site at Angerstein's wharf, Charlton, which had a frontage to the Thames of 675 ft. and an area of 26 acres. It could accommodate 3,000-ton steamers, and out of the 26 acres 20 acres were available for the purposes of a generating station. The nearest sub-station, at Lewisham, would be 3¼ miles away. Incidentally, counsel mentioned that the South-Eastern & Chatham Companies were now in a group under the Railways Act, consisting of the London and South-Western Railway, the London, Brighton and South Coast Railway, the South-Eastern Railway, the Chatham & Dover Railway, and the Managing Committee of the South-Eastern and Chatham Railways. The London & South-Western Railway and the London, Brighton & South Coast Railway had electrically-operated lines, and were working at 25 cycles. The Brighton Co. obtained its power from the London Electric Supply Corporation under an agreement which would expire in 1927, but it could be extended if energy could be supplied at a price not more than that at which it could be obtained from other sources. Dealing with the circumstances of the case, Mr. Clode said that in 1903 Parliamentary powers were obtained to adopt electric traction. Nothing was done, however, up to the time of the war, and, of course, during the war. Soon after the war came to an end, however, the attention of the company was repeatedly called to the need for electrification of the lines in order to give a better service. The difficulties in relation to finance were very great, but in November, 1921, the Trade Facilities Act came into force. Any guarantee of interest on principal under that Act must be obtained within twelve months of the passing of the Act, viz., November 12th, 1922, and the Managing Committee had been in communication with the Advisory Committee under the Act, which agreed that it was extremely important to carry out this electrification scheme. The whole position had been considered, and at first some 94 route-miles, or 210 single-line miles were discussed, and later 241 route-miles, or 648 single-line miles, were considered, these being what might be termed the suburban lines. The Advisory Committee referred the matter to the Ministry of Transport, which appointed a committee of experts, presided over by Sir Philip Nash. The whole scheme was inquired into in its technical aspect, and the scheme for a power station at Angerstein's Wharf was approved. So far as he understood, there was no question as to the technical aspect of the scheme. Then the question of cost was inquired into, which was shown by the company to be between 6 and 6½ millions, and the Treasury was satisfied that it was reasonable. Upon that amount the Government said it was prepared to guarantee capital and interest if a satisfactory method for carrying out the work could be found. It had been decided to carry the scheme out in the form of an agreement, under which a construction company would be formed for the electrification of the London and suburban lines of the company and the erection of the power station. All this was subject to the sanction of the Electricity Commissioners to the erection of the power station. A draft agreement had been prepared, by which a construction company would be formed to build the power station, which would be leased to the railway company at a rent which would pay off the cost in 25 years. It was not proposed to make any public issue in the matter, as arrangements had been made for avoiding this. In that way it was hoped to get a scheme at the least possible cost. The transaction would be a loan by the Bank of England against securities and the guarantee of the Government. This agreement would be placed before the Ministry of Transport in relation to its powers to make orders for electrification schemes. A meeting of the shareholders had been called for June 2nd, 1922, for their consent, and there was every reason to believe that that sanction would be given. When that was obtained they would go to the Ministry of Transport for an Order, which would be equivalent to an Act of Parliament. The whole of this was a self-contained agreement, which hinged on the guarantee to be given by the Treasury, and unless it was got through before November, 1922, the opportunity would be gone. The company had obtained this guarantee, and cheap money, and if there was nobody who could give a supply at once they could not afford to wait. The terms of the guarantee were that the whole of the work should be carried through in three years. The Treasury and the Ministry of Transport were insistent that the scheme should be put in hand at once, to relieve unemployment. They would not get the guarantee unless both the power station and the lines were electrified in three years.

The Chairman: Do you suggest that if we decline to give permission for the power station the bargain will be off?

Mr. Clode said he did. If there was a stable concern which could give a supply, the position would be different, but there was no power station and he had been made no offers of a supply. He understood that the West Kent Co. said it would give a supply, but it had not got the Commissioners' consent to build a power station. Moreover, the proposal of the West Kent Co. was very strongly objected to by others; therefore, how could that company say that it was in a position to make an offer to give the railway company a supply? Even when the West Kent Co. had obtained the consent of the Commissioners it would only have won through to the first stage, and his submission was that the railway company, having made a *prima facie* case for the consent of the Commissioners, it was for the West Kent Co. to show that it could do better in the matter of supply.

In answer to Sir Harry Haward (one of the Commissioners) Mr. Clode said that if the Commissioners did not give consent to the erection of the power station, the whole of the negotiation with the Treasury would have to begin again, because the consent to the guarantee was based upon the whole scheme, generating station and lines, being completed in three years. The capital of the construction company was to be £10,000, and it was to make no profit, and the Treasury agreed to enter into an agreement with the construction company for guaranteeing principal and interest to the extent of 6½ millions sterling.

Sir Harry Haward said that the scheme contemplated no other arrangement than that the construction company should erect a power station, and that seemed to have a very important bearing on the proceedings of this inquiry.

Mr. Clode said the whole scheme turned upon the proposal going through as a whole.

The Chairman said it would be reducing the proceedings to a farce to tell the Commissioners that this agreement could not be departed from, because it involved that the Commissioners could not inquire into this scheme except with the generating station.

Mr. Clode said he did not make that suggestion. What he intended to do was to place the complete scheme before the Commissioners, and then leave it for others to say they had a better scheme. The onus was on other people to do this.

When the inquiry was commenced on May 30th, there were, more or less optimistic, hopes that it would be completed before the Whitsun holiday. The proceedings had not lasted a day and a half when it was realised that not only would the inquiry last throughout the week before Whitsun, but that it might not be concluded during the week following Whit Sunday. Eventually, an adjournment was made on June 1st until the following Wednesday, Sir John Snell intimating that it was essential to finish by the end of Whitsun week.

Following the opening statement by Mr. Clode for the S.E. & C. Railway Co., evidence was given on May 31st and June 1st, in support of the scheme and the whole of the case for the Railway Co. was completed before the adjournment. The principal witnesses were Mr. Cosmo Ponsor, chairman of the company, Mr. C. P. Sparks, who had been called in to give evidence as an independent expert, upon the

technical soundness of the proposals, and Mr. Alfred Raworth, the electrical engineer to the S.E. & C. Railway. Evidence was also given by Mr. J. H. Thomas, M.P., on the point of necessity to get to work quickly in order to relieve unemployment; Sir Arthur Bryceson, town clerk to the Woolwich Borough Council, also gave evidence to the same effect. Mr. Harry Jones, electrical engineer to the L. & S.W. Railway Co. was also called and gave information about that company's power station.

The most important evidence was that of Mr. Sparks and Mr. Raworth. The real point at issue, as indicated by the Chairman on several occasions when counsel was tempted to wander unduly into past history, was whether the railway company's proposal was a better one in all respects than any other, and whether any of the opponents to the scheme were prepared to make a definite offer to supply power by the time when the railway company's power station had to be completed under the agreement with the Advisory Committee, under the Trade Facilities Act, viz., in three years. The necessity for electrification was agreed, said the Chairman.

Summarising the evidence, generally, the proposed power station would have a total output of 150,000 kW, and would be dealt with in sections. There would be sub-stations at Lewisham, Redhill, Tonbridge and Rochester, but for the first portion of the scheme the supply would all be transmitted to Lewisham. One of the questions as between the two schemes, *i.e.*, those of the railway company and the West Kent Co., was the extra cost in the case of the latter of transmission to the Lewisham sub-station, the West Kent Co's. power station being farther away. The plans for the railway company's power station had not yet been drawn up, but it was put forward as possible that a pressure of 11,000 V. for both generation and distribution would be used. The maximum cost at the Lewisham sub-station was put at 0.5d. per unit. The pressure proposed at the rails was 3,000 volts. The first stage would include all lines within a 15-mile radius of Charing Cross, the maximum demand for which was put at 29,300 kW, calling for an output of 90,000,000 kWh per annum; the second part of the first stage would include all lines within a radius of 30 miles of Charing Cross, and would call for 57,000 kW maximum demand and 222 million kWh per annum, whilst the complete scheme would have a maximum demand of 114,000 kW, and require 444 million kWh per annum. It was the first stage which had to be completed in three years, under the agreement with the Advisory Committee. A periodicity of 25 cycles was proposed, and 15,000-kW sets would be installed at a capital cost of £4 10s. per kW, based on recent tenders for the turbo-generators. The boiler house would contain 10 boilers having an evaporative capacity of 50,000 lb. of steam per hour, with a pressure of 350 lb. per sq. in. The cost of the transmission cables was put at £4,650 per mile. A mass of tables was put in by Mr. Sparks dealing with the details, but these were the broad outlines.

Correspondence was read between the railway company and the West Kent Electric Power Co., relative to the erection of the Power Co's. station, the suggestion of the Power Co. being that the supply would be more advantageous if taken from a general power station than if taken from a railway power station. The Railway Co., however, whilst accepting the principle that a supply should be taken from an outside source, if it could be obtained more cheaply in that manner, pointed out that the evidence in its possession did not show that the West Kent Co. could give a cheaper supply than the Railway Co. could generate at for itself. At the same time, counsel for the Railway Co. emphasised the point that it was always willing to receive an offer but that in fact no offer had been received. One incident arising out of the correspondence caused Sir John Snell to enter a strong protest. In one letter from the West Kent Co. it was stated that as the result of a recent interview with the Commissioners, the impression left upon the minds of the West Kent Co's. representatives was that the Commissioners were not desirous of sanctioning a power station for railway purposes, but were willing and anxious to sanction the West Kent Co.'s proposed power station. Sir John Snell said he must emphatically deny that any statements were made which could give rise to that impression. Counsel on both sides agreed that this was merely an expression of opinion on the part of the West Kent Co., and in no way prejudiced the proceedings

Mr. RAWORTH said that throughout the whole of the negotiations between the Railway Co. and the West Kent Co. he had never received an offer which he could recommend his general manager to accept, because he had never received an offer quoting a price. He had given the West Kent Co. an estimate of the requirements of the Railway Co., but had never been quoted a definite price, although the West Kent Co. did offer to supply at a price based on a principle. Negotiations had also been carried on with the London Electric Supply Corporation towards the end of last year, to which he had also given the probable maximum demand, viz., 29,200 kW for one hour, and 85,250,000 units per annum. In that case, Mr. Partridge said he could not make an offer until the result of the London inquiry, last year, was known. A fortnight ago, however, Mr. Partridge made an offer on behalf of the London Electric Supply Corporation, the South Metropolitan Co., and the West Kent Co. in general terms, verbally, to supply from a station at Belvedere, at a cost equal to the cost of generation by the Railway Co. itself. He had also had a proposal from Mr. Oliver Bury, a director of the London Electric Supply Corporation, who said that in addition to the interest on capital, he would require a profit of 3 or 4 per cent. He reported to his general manager that there did not seem much likelihood of doing business.

The CHAIRMAN put several questions indicating his view that the Railway Co. should have asked for a definite quotation in figures from the West Kent Co.

WITNESS replied that he had given an estimate of his demand to both the West Kent Co. and the London Electric Supply Corporation, but neither of the offers received was in specific terms, and it was because of this that he came to the conclusion that the Railway Co. could supply itself more cheaply than it could buy power from any outside source.

Mr. TYLDESLEY JONES, K.C., for the West Kent Co., in the course of cross-examination, suggested that witness had made up his mind from the beginning that the West Kent Co. could not give the supply, but Mr. Raworth replied that his mind was quite open to begin with, but after the negotiations, he came to the conclusion that the West Kent Co. could not supply on suitable terms or as quickly as the Railway Co. could.

In the course of further cross-examination it was made clear that the original application to the Advisory Committee, under the Trade Facilities Act, was for five millions sterling, which did not include the power station. Later it was increased to 6¼ millions sterling, to include the generating station, because the Railway Co. came to the conclusion that it could not get power from outside.

Mr. TYLDESLEY JONES contended, therefore, that the generating station was not a condition of the guarantee, although it was now part of the arrangement that had been come to.

The CHAIRMAN said the point was whether the West Kent Co. could give evidence as to the price at which, and when, it could give a supply to the Railway Co. That was the practical point; such evidence could then be tested against the figures of the Railway Co.

Mr. TYLDESLEY JONES then put questions dealing with the cost of supplying from Belvedere (West Kent Co.) as against the Angerstein Wharf scheme, in respect of site, extra cost of transmission, &c., indicating that the figures for these purposes were unduly high as regarded the West Kent Co's. station, as assumed by the Railway Co. In the case of the South-Eastern Co., nothing had been included for the cost of the land, as it was the property of the Railway Co.

The Hon. EVAN CHARTERIS, K.C., for the County of London Electric Supply Co., elicited that no communications had been made with that company in order to ascertain whether it could supply at a cheap enough rate.

Mr. RAWORTH said that if the Railway Co. could obtain a supply from an outside source at a suitable price, he would not hesitate to recommend its adoption.

Answering the Chairman, as to whether any communication had been made with the L.B. & S.C. Railway, Mr. Raworth said he had had a conversation some time ago with Sir Philip Dawson, but nothing had been done. As to the position if the L.B. & S.C. Railway and the S.E. & C. Railway obtained their supplies from different sources, witness said that it seemed to him a pity that this should be so, because the combination of the two railway loads should bring about a reduction in cost, although it would not improve the load factor. The same thing applied to the large general station supplying other than railways. The supply should be cheaper under these circumstances, but, as things were, there was no such station from which a cheaper supply could be obtained. His original recommendation to his company was that if it were possible to obtain an outside supply under proper conditions, it was the best plan to adopt, and that accounted for the fact that the first application to the Advisory Committee did not include the cost of a generating station.

Mr. SYDNEY E. HITCHCOCK, rating surveyor to the Managing Committee of the S.E. & C. Railway, gave evidence as to the rates which would be payable on the Angerstein Wharf station; when in operation with an installation of 60,000 kW, the rates would be £12,000 per annum; with 90,000 kW installed, the rates would amount to £18,000; and when the full 150,000 kW was installed, the rates would be £30,000 per annum, on the basis of 15s. in the £. The rates, however, were much higher in Erith, where the Belvedere station would be, being at present about 27s. in the £, as against 17s. in the £ at Greenwich, where the Angerstein Wharf station would be, so that the West Kent Co. would have a higher cost in this respect.

Sir ARTHUR BRYCESON, Town Clerk to the Woolwich Borough Council, spoke of the need for better railway accommodation. His counsel was of the opinion that nothing should be done to hinder the electrification of these lines even for six months.

During the later proceedings, Sir John Snell asked Mr. Kennedy, representing the Joint Committee of the London Companies, whether he was prepared to make a definite offer.

Mr. KENNEDY said he thought he could say "Yes" to that, judging from what he had been instructed during the morn-

ing. At the moment. there was no one present who could definitely instruct him.

Mr. CLODE, for the Railway Co., said he would require a guarantee on the payment of the debentures of the Construction Co., and several other details of that nature, including damages for failure to supply, as part of any offer of Mr. Kennedy's clients.

Mr. TEMPEST, general manager of the S.E. & C. Railway, said that whilst he preferred to have the generating station under his own control, if an outside company could be tied down to give the necessary guarantees, it would go a long way towards changing his opinion.

The inquiry was then adjourned till Wednesday, June 7th.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Wild-Barfield" Marine-type Furnace.

A special type of "Wild-Barfield" furnace has been developed by AUTOMATIC & ELECTRIC FURNACES, LTD., 281-283, Gray's Inn Road, W.C.1, especially for marine purposes. This is illustrated in fig. 1, which also shows the control board. A patent excess-temperature cut-out, which comes into action when the temperature reaches 960 deg. C. is fitted, the normal working temperature being between 800 and 900 deg. C. The cut-out consists of a silver wire at the bottom of the furnace, in series with the heating winding. Thus the fusing

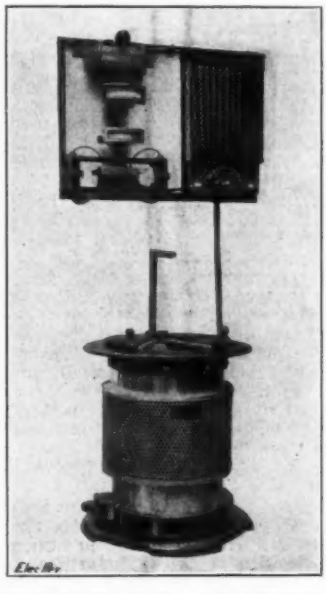


FIG. 1.—THE "WILD-BARFIELD" MARINE-TYPE FURNACE.

of the wire cuts off the heating current. A red pilot lamp is shunted across the silver wire, and is illuminated in the event of the wire's fusing. The fuse carrier is seen at the bottom left-hand side of the furnace. The construction of this is similar to an ordinary clip fuse, and consists of a plug with spring contacts, which can be withdrawn and a new fuse at once inserted, thus saving any delay in hardening operations. The non-magnetic point indicator is the top instrument on the left-hand side of the control board. The lower instrument is an ordinary pyrometer, and the controlling resistance is on the right-hand side.

The company informs us that it has received orders for this furnace from all parts of the world.

Radmolite.

The MOLER FIREPROOF BRICK & PARTITION CO., LTD., has developed from its refractory material new forms specially adapted for use in electrical heating and cooking apparatus under the name of "Radmolite," for which Messrs. Lionel Robinson & Co., of 3, Staple Inn, London, W.C.1, are the selling agents. Radmolite is largely composed of diatomaceous earth, and is a highly efficient thermal insulator; it can be used as an electrical "fire bar," and absorbs so little heat that the element attains its full temperature very quickly after switching on—an attractive quality from the popular point of view, as radiant heat is immediately available. It can be supplied moulded to any of the usual shapes. An important point in view of the export trade is that it is very light as compared with fireclay bars. Tests made by the National Physical Laboratory showed that, under identical conditions, a heating element made with the Moler Co.'s composition attained its final temperature in less than half the time taken by a similar fireclay element; the radiation from the former was 7 per cent. greater than from the latter, and the "apparent black body" temperature of the wires in the former case was 760 deg. C., as compared with 730 deg. C. Samples which we have before us show that "Radmolite" has a salmon-pink complexion, which is cheerful even when the element is cold; it is very light and porous, and seems well adapted for the purpose mentioned. Other "Moler" products are made for use in lagging electric ovens, &c., in the form of either slabs or granules.

The "Freezor" Oscillating Fan.

The advent of warmer weather leads at this time to the consideration of cooling arrangements, in which the electric fan holds the premier position. The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has recently issued a catalogue of its "Freezor" fans, among which is that illustrated in fig. 2. This is adaptable either to a bracket (as shown) or to a base suitable for a desk or table. A range of 110 deg. is provided for by the oscillating mechanism; the movement is

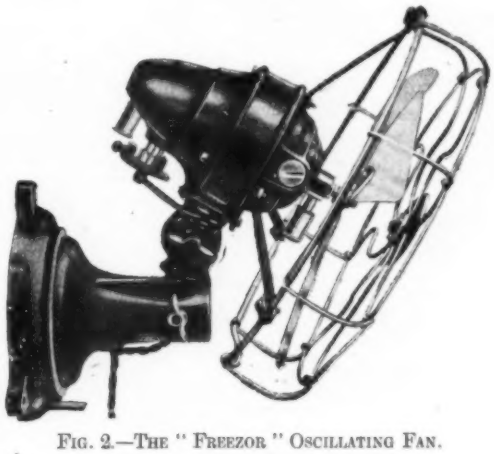


FIG. 2.—THE "FREEZOR" OSCILLATING FAN.

adjustable and will operate through any desired angle. A slipping clutch is fitted, which allows the blades to continue to revolve even if oscillation is prevented by some external obstruction.

A Commutator-Notching Machine.

We illustrate in fig. 3 a notching machine for commutators, made by MESSRS. JOHN PHILLIPS & CO., 166, Walworth Road, S.E.17. This is an easily portable appliance and can be used upon commutators *in situ*. The cutting medium is a small

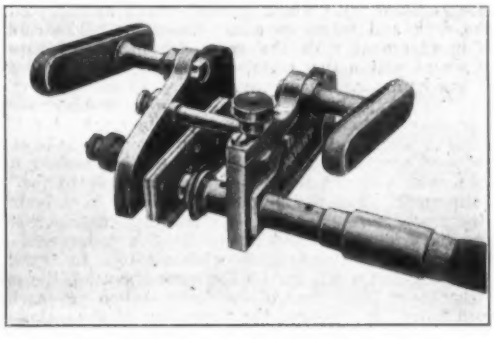


FIG. 3.—A COMMUTATOR-NOTCHING MACHINE.

circular saw mounted on a spindle which passes through a bearing block sliding into one side of the frame. The spindle forms the end of a flexible shaft, which can be driven by an electric motor, or by special hand-operated gear, supplied by

the firm. The guide slides over the carrier, enabling the machine to be moved forward until each slot is cleared out to the maximum possible distance. Twelve cutters are supplied with each machine; these are made in three sizes, of 1/64-in., 3/128 in., or 1/32-in., thickness.

A Deck-caulking Machine.

We illustrate in fig. 4 the "Clyde" deck-caulking machine, which has recently been put on the market by MESSRS. JOHN MCDOWELL & SONS, Johnstone, N.B. The makers of this machine claim that it entirely overcomes the many difficulties which the operation of mechanical caulking presents by means of an apparatus termed the "extended seam." This is a hollow guideway, so constructed and placed as to form an outward and upward extension of the seam to be packed. Within the tapered opening formed by the adjustable walls the oakum is compressed by the hammer, and passes down-

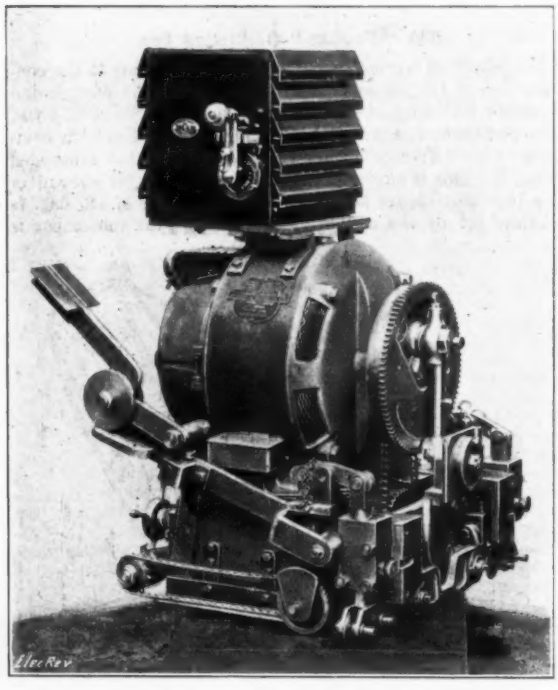


FIG. 4.—THE "CLYDE" DECK-CAULKING MACHINE.

wards and enters the seam in a partially compressed state, where it is easily driven into place by the point of the hammer. The hammer is tapered roughly to correspond with the walls of the extended seam, and the vertical reciprocating stroke is calculated to compress the material into a thread of suitable dimensions. The width of hammer can be made to suit any size of seam, and is driven direct by the flywheel of an electric motor of 3 b.h.p. A reversing controller is mounted on the top of the motor, and allows of variations of speed in either direction.

For the purpose of traversing the machine along the deck the base is fitted with fluted rollers, which are adapted to grip the deck and travel in either direction. The caulker is kept in alignment with the seam by means of tapered wheels placed within the seam, one set in front and one behind the hammer. These are designed to meet the many irregularities found in even the best-laid planking. The depth of blow given by the hammer is regulated by a hand arrangement placed in front of the gear casing, and is easily operated and accessible. The oakum thread is wound upon a bobbin, which carries about 450 ft., the supply to the tool being automatic. For the purpose of moving from seam to seam the machine is fitted with a cross-travel gear, which is operated by means of a foot lever. By the pressure of the foot the machine is lifted on to wheels placed to travel at right angles to the seam, and by the same operation the seam guide wheels are lifted clear of the deck. When the machine has been placed in position the threading of the oakum is performed in a few seconds with a special tool, and the caulker is then ready to start. The controller is put over rapidly to the full limit, and the machine runs without attention to the end of the seam, automatically drawing the oakum required from the bobbin. The machine, which weighs about 10 cwt., will caulk upwards of 40 ft. per minute, equal to the work of about 20 men, whilst only one attendant is required.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Turbines as Pressure Reducers.

We note in your last issue a reference regarding the use of steam turbines, by the Crockett Sugar Refining Works, of California, instead of pressure-reducing valves.

We might mention that such a system has been used during the last few years in France; most of the new beet sugar factories which have been erected in the northern part of France have been fitted with small steam turbo-generating sets in order to use the energy generally lost in pressure-reducing valves.

The sets vary in size from about 30 to 100 kW, according to the size of the plant, and the electrical energy generated is used for power and lighting purposes.

P. Dieny,
Dieny and Lucas, Ltd.

London, *May 30th*, 1922.

Electric Furnaces.

In a recent issue you reported on an exhibition of furnaces which had been held in Newcastle, and, being interested, I communicated with the firm concerned, but found that the apparatus was not likely to fulfil my requirements. I wonder if any of your readers are in a position to advise me if it is possible to obtain an electrolytic plant to treat a 50 per cent. zinc concentrate and produce pure zinc. The electrical plant available is a 440-volt, 3-phase, 40-cycle, 230-amp. generator, and I could give the whole of this current for use on the furnace, which would be expected to deal with, say, five tons of the concentrate per day.

Should any such plant be on the market I can foresee great business being done, as at present it seems to be unknown.

Adena.

May 31st, 1922.

Reconstruction and Foreign Trade.

There appeared in your issue of April 14th last, an article by Mr. Ernest T. Williams, O.B.E., M.I.E.E., setting forth a scheme of co-ordination bearing upon the revival of foreign trade, which scheme was first propounded by Mr. Williams in a paper which was published in 1916, entitled "Reconstruction and Foreign Trade."

Mr. Williams, in 1916, read before the Institution of Electrical Engineers, a paper on the electricity supply of Great Britain, by which attention was first focused upon the unsatisfactory state of that industry, and means indicated whereby, by proper organisation, such conditions could be remedied; the outcome of this was the reform which has since taken place, culminating in the passing of the Electricity Supply Act, 1919, and the appointment of Electricity Commissioners, by which means the electricity supply of Great Britain will undoubtedly be greatly improved.

This fact is, in the view of the present writer, sufficient to justify careful consideration of the further proposals now made by Mr. Williams, dealing with the wider matter of British foreign trade.

Some of the important features of Mr. Williams's scheme are as follows:—

1.—Mr. Williams points out that there are many aids to British foreign trade, such as the Diplomatic Consular Services; the Overseas Trade Department; Chambers of Commerce; the Federation of British Industries, and similar organisations; but they are lacking in co-ordination both in England and abroad. He urges that if a co-ordinating body be set up under the control of trade itself, the latent possibilities of all these organisations will be rapidly developed, and a complete scheme is worked out showing how this co-ordinating body would be organised at home and overseas.

2.—The following important features are provided for in the scheme:

(*a*) Provision is made for Dominion representation.
(*b*) All branches of trade, and also finance and law, are provided for.
(*c*) Participating organisations could retain their own functions and authority.
(*d*) There would be a London Council and Board, and also boards in important foreign centres, acting in conjunction with the London board.
(*e*) There would be no Government control or interference.
(*f*) The organisation should, before long, be self-supporting.

3.—Mr. Williams maintains that an important Trade Council, as proposed, being under the control of trade itself, with a limited representation of Home and Dominion Governments, would be able to investigate problems from every standpoint and to speak with a united voice of great authority, thus being able powerfully to influence trade revival and expansion.

In the present state of unemployment and trade, it is im-

perative that anything that might conduce to the stimulation of foreign trade should not be neglected. My purpose, therefore, in asking you to be good enough to find space for this letter, is to call attention to these proposals, and to support Mr. Williams's advocacy of the setting-up by the Government of a committee to consider them, and any similar ones which may be suggested.

Geo. V. Twiss,
Managing Director,
Twiss Electric Transmission, Ltd.

London,
May 30th, 1922.

Fault Localisation.

With reference to "Review Reader's" high resistance fault, mentioned in the "Correspondence" Columns of the ELECTRICAL REVIEW of March 24th, the writer had a fault some time ago on a 3-core cable operating a 5,500-volt, 3-phase system, which, he thinks, would interest your readers, and perhaps assist "Review Reader."

The cable was an e.h.p. 0.075 sq. in., three-core, paper insulated, lead-covered, laid solid in troughing, 4,752 yards long.

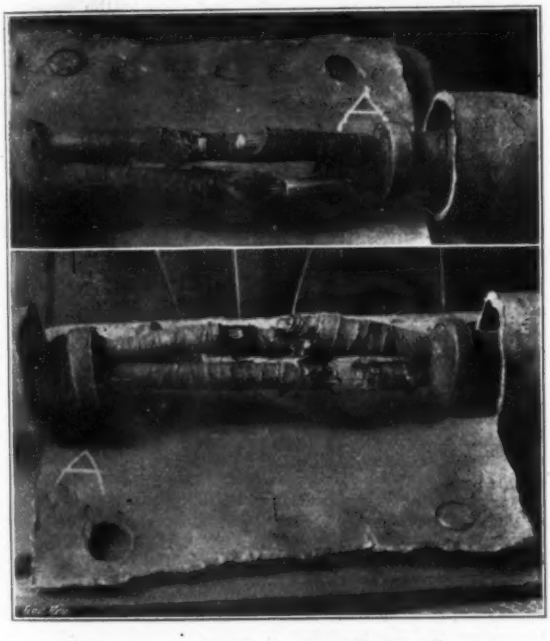
By megger test it was found that the insulation resistance between cores and from each core to earth was 15 megohms. Nos. 1 and 2 phases were open-circuited; No. 3 phase was continuous.

The test applied was to charge No. 3 phase and discharge it through a galvanometer, noting the deflections.

The other two phases were then charged and discharged in the same way, and the deflections noted.

No. 3 phase gave a deflection of 24 divisions.
No. 2 phase gave a deflection of 11 divisions.
No. 1 phase gave a deflection of 11 divisions.

The position of the fault was calculated to be at $4,752 \times 11/24 = 2,178$ yards from the test end.



PHOTOGRAPHIC VIEWS OF THE FAULTY JOINT.

The ground was opened up and a joint found; the joint was opened, and it was seen that in two of the ferrules the cores had parted, in fact, it looked as though the ends had been blown apart under load conditions, and there were distinct signs of arcing on the ends of the cores.

The three cores appeared to have been blown apart as far as the lead sleeve would permit.

The third ferrule was loose, but was making good enough contact to permit of the test being carried out; this core was easily parted by pulling the ends out of the ferrule.

As far as the writer could see, the joint appeared to have been well made, and the ground on both sides and underneath the joint box was well consolidated.

In the opinion of the writer the fault was caused by electro-dynamic action set up by the heavy surge which developed as the result of a fault on another cable, which was in parallel with this one.

The writer would be glad to have details of any similar fault with which any of your readers may have had experience.

C. B. Marshall.

Bombay, *May 12th*, 1922.

"State Salary Required."

With reference to advertised vacancies, and the question of remuneration, there seems plenty of room for improvement, and I think if the advertisers could put themselves in the applicant's shoes, they would do differently.

Take this week's vacancies: (1) For an assistant: the position might be worth anything between £150 and £450. (2) Electrical engineer for the Port of London: might be paid at any rate between £400 and £1,200. (3) Ship engineer: no details of size of station and no particulars of salary asked for; and many others that did not interest me.

Surely the parties concerned know how much they are going to pay, and as things are at present it is generally possible to obtain a man who is prepared to work below his own market value. It seems distinctly unfair to the applicants, and it would save the advertisers a lot of trouble if the wages hanging on to the jobs were published.

If one undervalues one's services there is a fair chance of not getting an appointment that may be worth more than the figure suggested by the applicant, and if the opposite course is adopted, again an opportunity of obtaining suitable employment may be lost.

A.M.I.E.E., &c.

June 3rd, 1922.

REVIEWS.

Modern Methods of Welding as applied to Workshop Practice. By J. H. DAVIES. Pp. xviii+263; figs. 132. London: Constable & Co., Ltd. Price 21s. net.

This is one of the books which make the kindly reviewer sad at heart. It might so easily have been a thoroughly good and useful guide to the would-be craftsman and to his instructors. Unfortunately the author has neither arranged what he desired to impart in a clear and orderly sequence, nor has he learned to write English correctly and simply. In consequence the book is a perpetual irritant to any reader with a sense for language, and a confusing guide to any who come fresh to the subject without sufficient knowledge to see through the author's ambiguities, to fill up his incomplete statements, and to correct his errors. It is fair to say that there are not many positive errors of statement and that some of these are probably due to imperfect correction of proofs.

The author is a member of the teaching staff of Leeds University, and that he should have written a book which teems with examples of bad English lends point to the recent complaints of some of our "pastors and masters," that inability to write good English is a common fault among those supposed to be educated, and their protest that the teacher in any subject in an English school or college should be incidentally a teacher of English.

The bulk of the book deals with acetylene welding.

Mr. Davies evidently understands this method very thoroughly, and is probably a successful teacher in the classroom and at the bench. But he does not understand the use of the written word as a teaching medium. Consequently, whilst anyone who aspires to train acetylene welders in the whole mystery of that craft may find the book useful in its detailed descriptions of apparatus and methods, he will wish that the author had arranged his work in a more orderly fashion, and had not divagated into theoretical subjects or repeated himself so often.

These excursions into chemical, physical, and metallurgical theory are unfortunate. The statements are frequently so incomplete as to be either meaningless or misleading to a reader with no previous knowledge of the subjects, irritating and superfluous to a reader who has such a knowledge. They are not always so accurate as they might be.

The chapter on oxy-acetylene cutting is one of the best, giving a fuller description of the apparatus, the methods of using it, conditions to be observed, and capabilities of the process than has previously come under the reviewer's notice. Its use has not been so fully developed in this country as it merits.

Out of the thirty-nine chapters, only six are devoted to the various forms of electric welding. The writer is not very happy in his handling of electrical subjects and measurements, and does not appear to have the intimate practical knowledge of any form of electric welding, which is manifested in his treatment of acetylene welding.

The chapter on "Eye Protection in Iron Welding Operations" is quite useful, giving the transmission spectra of a number of named glasses, and correctly pointing out that good transmission in the yellow-green, combined with opacity in the infra-red, red, violet, and ultra-violet portions of the spectrum is the ideal to be aimed at in selecting screens for hoods and goggles.

The book has no index, a fault in any book, more serious in this one than usual, because of the lack of arrangement in the matter. Some of the illustrations are not well described by the legends below them.

E

It is distasteful to have to write thus of a book to which the writer has certainly devoted much labour, time and knowledge. If he tries his hand again he will be well advised to devote more attention to the arrangement of his matter, to enlist the assistance of someone with a sense of style, and either to leave theory alone or make his theoretical explanations at once more complete and more precise.

Rays of Positive Electricity, and their Application to Chemical Analysis. By SIR J. J. THOMPSON, O.M., F.R.S. Pp. x+237; figs. 42, plates 9. London: Longmans, Green & Co. Price 16s. net.

Science is a plant that struggles upward to the light by very many shoots, but they do not all grow at the same speed, or at least they do not all grow with equal speed at the same time. On the contrary, notable growth takes place now at one place, now at another, and the public interest naturally centres at the particular place where growth is fastest. It is indeed there that everyone finds hope the strongest, because in the truest sense the growth of one is the growth of all, for there is no telling what unsuspected help, by way of law or analogy, may be forthcoming from any quarter, however remote, if it be from a part of the great tree of knowledge that is to bear the whole truth. Each half century, each quarter century even, is characterised by the progress made therein, according to the particular department of science where progress was greatest. At the present time the germinating bud which promises most of immediate attainment is the structure of the atom. Here at any moment some discovery may be made, destined to immensely advance our knowledge of science and revolutionise perhaps both industry and commerce. For this reason books like that before us, which epitomise recent progress in and about this region of active growth, are sure of a hearty welcome, which will be the better deserved in this case, in that the problems involved are treated with unusual clearness and lucidity. As is seen by the sub-title, the author particularly addresses himself to the task of showing the advantages to be gained by using the positive ray for purposes of chemical analysis. If only the appliances required for the production of high vacua are available, the method offers few difficulties of technique, and is surprisingly sensitive. It is even more sensitive than the spectrum analysis, and does not need more than an infinitesimal amount of material, while special purification is unnecessary. The main interest of the book, in the form in which it first appeared, as far back as 1913, centred in this application of the positive rays. The present edition contains much matter even more poignant. Especial attention is given to those properties of the positive rays which shed light on problems of the structure of atoms and molecules and combinations of molecules. The examination of the gases given out when solids are bombarded by cathode rays, is fully described in a manner that cannot fail to fasten the attention of anyone who takes an interest in the progress of science at its growing point. The passage dealing with the nature of X, the substance "giving the 3-line" is positively thrilling to anyone capable of emotional response to problems of discovery. There is really no reason why the sole source of emotions of this kind should be confined to discovery of crime. "The origin of the line $m/e=3.5$" is the heading of a section of some seven or eight pages equally exciting. The determination of atomic weights by the positive rays means hard work and perseverance in detail and routine; it represents the more prosaic aspects of investigation and occupies the last pages of this admirable volume.

To persons on the look-out for money-making inventions, the book may also be commended, because the field it covers is just the field where new and useful applications of science to art are most likely to be found at this moment. Many new and unexpected behaviours of atoms of the various elements, under reproducible electric conditions, are described, some of which are sure to be bearers of fortune to the enterprising individual who first perceives how they may be applied to assist the every-day purposes of his fellow men.

Modern Electrical Theory. Supplementary chapters. "Series Spectra." By NORMAN ROBERT CAMPBELL. Pp. vi+110; figs. 4. London: Cambridge University Press. Price 10s. 6d. net.

The author desires that his book on "Modern Electrical Theory" should be always up to date, and as the progress of the science is too rapid to permit of fresh editions following one another fast enough to keep up with it, he has adopted the plan of writing a series of monographs dealing with the more important advances in physics, as they occur, in the form of supplementary chapters to his book, numbered accordingly. This is Chapter XV., the first of the supplementary series, and contains references by chapter and page number to Chapters I.-XIV. of the book as already published. Any one who desires to begin the study of some of the strange problems which have arisen from recent advances in the investigation of radiation, cannot do better than possess himself of this work. The subjects treated of embrace the origin of homogeneous radiation, the regularity of spectral series, the intensity of spectral lines, band spectra, X-ray spectra, and, finally, the states of an atom wherein is sought the explanation of all these phenomena. The phenomena of radiation, as most people are now aware, seem to defy any means of explanation by classical mechanics. Herein lies the fascination of the new research. The dominion of Newton's laws can be shaken off without reproach, and this gives a huge freedom for the scientific imagination to disport itself, which is to many minds an irresistible attraction. There will always be people to declare that the new mechanics creates more problems than it disposes of, but adventurous minds were never deterred by considerations of this kind.

The complexity of the spectra of even the simplest bodies, *e.g.*, hydrogen, has always been a puzzle to physicists. What at first were taken to be single lines were soon found to separate into components when greater dispersal was obtained, and when further decomposition came to an end the component lines remained of a definite breadth, involving a variation in frequency of vibration which was hard to explain until it was found to be accounted for by the motion of the emitting molecule, on much the same principle as the changing pitch of a locomotive whistle as it passes you is explained by its altered motion in respect to the position in which you stand. Next, the various frequencies implied in the several lines of a spectrum were found to be capable of being expressed as differences between certain quantities called *terms*. Of course quantities can always be found such that their differences serve to express any arbitrary number of frequencies whatever. But here it was discovered that the *terms* having been determined, every difference between any pair of *terms* expressed the frequency of a spectral line. Consequently there could be no doubt that the existence of these terms corresponded to something of physical importance, and that that something must be looked for in the constitution and behaviour of the atom. Now, an atom of hydrogen, consisting as it does of one electron revolving about a proton, might be expected to create a spectrum of few lines, but this is far from the truth. In an admirable passage beginning on page 39, the author explains why, and gives at the same time a lucid account of the reasons that lead to the abandonment of the Newtonian mechanics as a possible means of explaining this difficulty, and others by which the subject is beset.

Factory Accounts in Principle and Practice. By GARCKE and FELLS. Revised by J. M. FELLS, C.B.E. Pp. xx+290. Illustrated. London: Crosby Lockwood & Son. Price 15s. net.

This work, which was first published in 1887, has now reached the seventh edition, the sixth having appeared in 1911; no better testimony to its value as a standard work could be desired. It has now been brought up-to-date by Mr. Fells, to whom Mr. Garcke records his indebtedness, and in a foreword the former discusses the subject of "cost accounting" on a scientific basis, and the growing appreciation of its importance. When "Factory Accounts" was first published, the subject was receiving little attention; nowadays it is realised that a continuous ascertainment of the costs of production is indispensable to the efficient conduct of a factory. This is but another instance of the development of a science by the application of accurate measurement, from the primitive stage in which estimates (*i.e.*, guess-work) are relied upon. Consequently, when measurement is applied, the necessity of accurate terminology becomes apparent, and in the foreword Mr. Fells dwells upon the difficulties that accountancy has met with in the course of its development, due to the laxity of usage in this respect, as well as the erroneous conclusions that may result from an improper choice of the units on which the statement of costs is based. Such obstacles can only be removed by close co-operation between the technician and the accountant.

Remarking in the preface that the new edition appears at a time of marked industrial unrest, and "dissatisfaction on the part of both employers and employed with the existing relations between Capital and Labour," the authors state that these questions have become too important to be dealt with in a technical work, and they have, therefore, omitted the chapter on "Methods of Remunerating Labour," which appeared in previous editions; they record their opinion, in which we heartily concur, that the regrettable difference of view as to such matters between the parties prevents the attainment of the highest degree of efficiency in production, and is to the prejudice of all interests.

New Cable Works in Germany.—A new cable factory is being erected at Ketschendorf, on the Spree, by the German Cable Works Co., of Lichtenberg, Berlin, and the works are said to be making good progress. It is estimated that the expenditure on the factory will amount to 100,000,000 marks, which is partly to be defrayed by an increase of 40,000,000 marks in the company's share capital, of which one-half will be issued at the price of 200 per cent.

BUSINESS NOTES.

Bankruptcy Proceedings.—William Francis, 4, Prospect Place, Cheam, Surrey, electrical engineer.—The first meeting of the creditors of the above was held on May 30th at 29, Russell Square, W.C.1. The statement of affairs showed liabilities of £711, while the assets were estimated to realise £22, from which £13 had to be deducted for preferential claims, leaving net assets of £9, or a deficiency of £70. Debtor attributed his failure to losses on contracts and high interest paid to moneylenders. It appeared that prior to August, 1915, debtor was employed as an electrician. In August, 1916, he started business as an electrician at his present address without capital. The business steadily increased until early in 1920, when he made a loss on a sub-contract and was sued by a creditor for £36. He had had recourse to money-lenders. A full set of books had not been kept. Debtor became aware of his position in April, 1920. The case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
Friswell, Sir C.	375	Leyton Timber Co.	16
Southern Electric Co.	17	Rowe & Ball	15
B.E. Co.	10	Reeves, A. H.	75
Johnston, G. W.	50	Howard, H. W.	59
General Cable Mfg. Co.	40	Times Electric Co.	21
Newbald & Co., E.	12		

Reginald Silver Magson, trading as R. S. Magson & Co., 10, Stoney Stanton Road, Coventry, electrical engineer.—The first meeting of creditors herein was held recently at the Official Receiver's office, The Barracks, Smithford Street, Coventry. According to the statement of affairs the liabilities amounted to £497, while there was a fully-secured creditor for £105, holding securities valued at £130, leaving a surplus of £25. The net assets were £283, or a deficiency of £213. Debtor attributed his position to illness of himself and family. The case being a summary one, was left in the hands of the Official Receiver as trustee. The following are creditors:—

	£		£
Balmford, W.	26	Hutt Bros.	10
Drake & Gorham	26	Magson, W.	82
Franklin, J. J.	130	Morris	50
General Electric Co., Ltd. ...	30	Siemens Bros. & Co., Ltd. ...	86

George Hill, George Noble, and Edgar Cowley, trading as George Hill & Co., 22, Chantry Lane, Gt. Grimsby, electrical engineers.—The public examination of these debtors was held on June 1st at the Town Hall, Gt. Grimsby. The statement of affairs showed liabilities of £426, and there was a deficiency of £217. It appeared that the business was commenced by G. E. Hill and G. Noble in January, 1919, with a joint capital of £200, provided in equal shares. In November, 1920, E. Cowley joined them, bringing in a borrowed capital of £150. Debtors estimated their turnover in 1919 at £1,000, in 1920 at £2,000, and in 1921 at £1,400. No balance sheets had been prepared. They became aware of their position about a year ago. They attributed their failure to loss on contracts, insufficient capital, and loss on stock owing to fall in prices.

J. G. Grieve and A. A. Manges (the Up-to-date Electrical and Mechanical Engineers), electrical and mechanical engineers, 14, West Bute Street, Cardiff.—Receiving order made May 31st, on debtors' own petition.

T. G. Coaton (T. G. Coaton & Co.), electrical engineers, 16, Humberstone Road, Leicester.—Receiving order made May 29th on debtor's own petition.

Company Liquidation.—Aqua Electric Co., Ltd., electric geyser, &c., manufacturers, 116, Putney Bridge Road, London, S.W.15.—In pursuance of the provision of the Companies (Consolidation) Act, a meeting of the creditors of the above was held on Monday, at the chartered Institute of Secretaries, 59a, London Wall, London, E.C. Mr. C. H. McKnight, C.A., 36, New Bond Street, London, E.C., stated that the company had gone into voluntary liquidation, and had appointed him as liquidator. He had prepared a statement of affairs, from which it appeared the liabilities totalled £1,586, made up as follows: trade creditors, £530; creditors for rent, electricity, and gas, £99; and unsecured cash creditors, £958. The assets were estimated to realise £250, or a deficiency of £1,336 so far as the unsecured creditors were concerned. The assets consisted of book debts, £135, estimated to realise £100; plant, tools and stock (book values), £700, expected to produce £100; and furniture £309, valued at £50. In addition the drawings appeared in the books at £320, and patents and experimental expenditure totalled £3,171. No value was placed on these two items in the statement of affairs. After a short discussion a resolution was passed confirming the voluntary liquidation of the company, with Mr. McKnight as liquidator. The following are creditors:—

	£		£
The Aluminium Plant & Vessel Co., Ltd.	188	Ward, Perks & Terry	39
The Delancy Tool & Engineering Works	72	Kensington Stamping Co., Ltd.	13
Butler, Spragg & Co., Ltd. ...	54	Wade, George, Ltd.	26
Westminster Tool & Electric Co., Ltd	21	Midland Presswork Co., Ltd. ...	11
		Lemuel Bell & Co.	10
		Creditors under £10	22

Dissolution of Partnership.—H. J. Marsden & Co., automobile, electrical and mechanical engineers, De Montfort Street, Leicester.—Mr. H. J. Marsden and Mr. E. J. Hutchinson have dissolved partnership. Mr. Marsden will attend to debts.

Private Arrangements.—John Thomas, 19, Porth Street, Porth, Rhondda Valley, plumber, gasfitter and electrical engineer.—The creditors were called together recently at the offices of Messrs. Clarke, Dovey & Co., accountants, Cardiff, when a statement of affairs was presented, which showed liabilities of £1,305. The indebtedness to the trade was £822, the balance being in respect of cash claims. There was also a fully-secured creditor for £150. After allowing £31 for preferential claims the assets were estimated to realise £212, or a deficiency of £1,093. The assets consisted of stock at cost £220, expected to produce £147; fixtures, fittings, and utensils, £29; life policy, £10; and good book debts, £57. Book debts of the face value of £226 were written off as bad. It was stated that the debtor commenced business in January, 1920, with a capital of about £630, and took over an existing business. At the outset the turnover was £33 per week, and it went up to £45 weekly, but had now dropped to £28 a week. The gross profit was estimated at about 15 per cent., while the outgoings were £13 weekly. Sympathy was expressed with the debtor, and it was decided to accept a composition of 6s. 8d. in the £, payable as to 2s. 6d. in three months, 2s. 6d. in six months, and 1s. 8d. in nine months. It was also decided that the matter should be carried through under a deed of assignment with Mr. S. E. Clutterbuck, of Messrs. Clarke, Dovey & Co., as trustee, with a committee of inspection. The following are creditors:—

	£		£
Baxendale & Co.	150	Rowe Bros.	21
Catterson & Sons, S. P.	27	Rose Bros.	34
English Electric and Siemens Supplies, Ltd.	116	Siemens Bros.	36
General Electric Co.	26	Shenton & Co.	61
Horwood & Co.	16	Smith, J. and W. B.	25
Ingersoll Watch Co.	17	Vivian & Sons	34
Morgan & Sons, D.	24	Witty & Wyatt	17
Mills, Henry	15	Wholesale Fittings Co.	23

Topfield & Robinson, Ltd., electrical engineers, Edmund Street, Birmingham.—In response to a circular letter issued by Messrs. Bailey, Cox & Co., solicitors, a conference of the creditors of the above was held recently at the Birmingham Chamber of Commerce, Birmingham, when a statement of affairs was presented, which showed ranking liabilities of £10,755, made up as follows: unsecured creditors, £2,476; bankers, £8,079; and contingent liability, £200. The assets consisted of cash in hand, £30; book debts, £2,000; stock-in-trade and work in progress, £4,500; furniture and fittings, £200; and plant and machinery, £270; or a deficiency of £3,755. With regard to the claim of the bank, it held debentures to the extent of £8,000. It was reported that the business was incorporated in May, 1920, with a nominal capital of £10,000, of which £6,500 had been allotted and paid for in cash. The company took over the Birmingham business of another concern as from November 1st, 1919, paying £1,880 for the goodwill. The first year's trading showed a profit of something like £300, but in the succeeding twelve months there was a heavy loss, which approached £4,000. That loss was largely due to heavy purchases of goods which could not be readily sold, and had since depreciated very seriously in price. The directors had never received any fees. The company also opened a London office, which resulted in a loss of over £1,000, and was closed. The company had effected economies to the extent of at least £1,300 a year, and also had a number of profitable orders on hand. The creditors unanimously decided to leave their accounts in abeyance for a period of six months, during which time they would not exercise any pressure subject to the directors reporting to a committee of inspection every three months, and to a report being issued by the committee at the end of six months. The committee consisted of the representatives of Callender's Cable Co., Sterns Electric Co., W. T. Henley's Telegraph Works, Co., the English Electric Co., and the Wholesale Traders' Association.

Trade Announcements.—The North-Eastern district office of Messrs. Ferguson, Pailin & Co., Ltd., has been removed to 90, Pilgrim Street, Newcastle-on-Tyne. Telephone number: Central 5574. Telegraphic address: "Tension, Newcastle-on-Tyne."

The Jeary Electrical Co., Ltd., has removed to larger premises in Glasgow at 95, Waterloo Street. It is carrying large stocks. Mr. John Grogan is Scottish manager. Telephone number: Central 5329.

Messrs. Hill & Provo, late with Gill & Co., have commenced business as electrical engineers at 36, St. Michael's Street, Oxford.

Messrs. Albert Lee & Co., Ltd., announce that Mr. W. P. Kerr, their Midlands and Northern representative, having resigned, the ground will, for the time being, be worked by the managing director, Mr. Thomas Harris, and the general manager, Mr. J. Edward Allden.

RADIO INSTRUMENTS, LTD., is the name of a new company formed for the production of wireless instruments of new design. Mr. J. Joseph, M.I.E.E., who has recently resigned his position as general manager for Mr. H. W. Sullivan, is managing director of the new company. We understand that he has been associated with the design and manufacture of wireless instruments for the past 23 years. Mr. W. A. Appleton, M.B.E., M.I.R.E., late Admiralty Technical Research Officer at H.M. Signal School, Portsmouth, has been appointed Director of Research and Chief Designer to the company, which has an illustrated and descriptive catalogue in course of preparation. The works, offices, and show-rooms are situated at 12a, Hyde Street, New Oxford Street, London, W.C.1. A special department will deal with laboratory standards and radio measuring instruments, and the company will also advise on high frequency and radio work.

Catalogues and Lists.—THE STEAM FITTINGS CO., LTD., West Drayton, Middlesex.—Two illustrated and priced pamphlets dealing respectively with electric temperature regulators "for rooms and liquids," and a thermo-contactor for giving alarms when a certain temperature is reached.

The SILUMINITE INSULATOR CO., LTD., The Green, Southall, Middlesex.—An illustrated catalogue giving a description of "Siluminite" insulating material, and details of sheets, insulators, and moulded fittings of this substance.

MESSRS. HIGGS BROS., Sand Pits, Birmingham.—Monthly magazine for June, containing stock lists of d.c. dynamos and motors and a.c. generators; notes on the setting of brush-holders, and humorous items.

MESSRS. SIEMENS BROS. & CO., LTD., Caxton House, Westminster, S.W.1.—An illustrated booklet giving a full description of the construction and uses of the "Multiversal" testing set made by Messrs. Elliott Bros. (London), Ltd.

THE NEW ITALIAN ART ASSOCIATION, LTD., 38, Newman Street, W.1.—Two illustrated lists showing examples of alabaster-bowl lighting fittings in numerous styles.

THE ELECTRICAL ALLOY CO., 4, Regent Square, W.C.1.—A publication dealing with resistance wires and ribbons for electrical heating purposes, embodying a set of charts for determining the current-carrying capacity of ribbons and strips, &c.

THE EDISON SWAN ELECTRIC CO., LTD., Ponders End, Middlesex.—List No. AA 253, containing a description of the manufacture of "Ediswan" accumulators, and giving illustrations and prices of various types.

AUTOMOTIVE PRODUCTS CO., 3, Berners Street, W.1.—Two illustrated pamphlets describing link "V" belting. Priced.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—List No. 909, containing very full illustrated details of conduits and accessories, including junction boxes, wall plugs, tools, &c. Prices are given upon a separate card.

Copper and Lead Prices.—Messrs. F. Smith & Co. report June 6th:—Copper (electrolytic) bars, £71 10s., 20s. increase; do. do. sheets, no change; do. do. wire rods, £81 10s., 20s. increase; do. do. h.c. wire, 10¼d., ¼d. increase.

Messrs. James & Shakespeare report June 7th:—Copper bars (best selected), sheet and rod, £94, £2 increase; English pig lead, £26, 15s. decrease.

E.D.A. Activities.—The Electrical Development Association has published an abstract of the lecture on "Electro-Farming," recently delivered by Mr. R. Borlase Matthews, M.I.E.E., before a joint meeting of the Irish Centre of the I.E.E., and the Royal Dublin Society.

The Association has sent us a copy of the order form used by the Winchester Electricity Department. At the head of this form the details of the supply are given, with an additional note that motors of over 2 h.p. are connected across the "outers" of the city's three-wire system. To give these particulars is not a general practice, but is obviously of great advantage, as this essential information is likely to be overlooked when ordering apparatus.

Book Notices.—"The *Electrician* Tables of Electricity Undertakings, 1922." (132 pp.) London: Benn Bros., Ltd. Price 10s. net.—The altered arrangement of the data instituted last year has been retained; this is an advantage permitting of quick reference. Among the new features of the present edition is a section devoted to data regarding Chilean undertakings. Additional information in connection with vehicle charging, showrooms, &c., appears, and the charges have been brought up to date, although these are still fluctuating, chiefly downward. Another feature of interest is an index to articles describing numerous undertakings which have appeared in the *Electrician*.

"The Official Municipal Year Book for South Africa," edited by W. P. M. Henderson and F. G. Pay (415 pp.). Cape Town: Publishers, P.O. Box 1136. London: E. G. Allen and Sons, Ltd. Price 25s. net.—This useful directory re-appears after an absence of eight years, during which period the joint editors were upon active service. Every city and township in the Dominion is included, and the information given comprises historical and topographical data, lists of officers, rateable value, &c. Section VI., which deals with electric light and power undertakings, takes up an important part of the volume, and the information contained in the section is very detailed in every case. Several items in a digest of legal decisions possess interest for the supplier of goods to the country. We consider that the book should prove a great aid to all British manufacturers and exporters, as indicating possible markets for their goods. To electrical manufacturers the section devoted to electricity supply should be of additional value.

The British Non-Ferrous Metals Research Association has just issued in its quarterly *Bulletin*, a union list of periodicals of interest for reference on industrial metallurgy. The service provided by 14 libraries in London, Birmingham and Manchester is clearly indicated so far as concerns the 118 periodicals which have been selected, and the next edition will include additional libraries and periodicals which experience with the present list suggests as desirable.

"The Engineer's Year-Book," edited by H. R. Kempe, M.Inst.C.E., and W. Hanneford Smith, M.Inst.Met. Pp. lxxxvi+2,520; figs. 2,250. London: Crosby Lockwood & Son. Price 30s. net.—The issue of this familiar old friend for 1922—the 29th year of publication— is practically the same size as that of the previous year, obsolete matter having been cut out to make room for the new sections and other additions. The volume has certainly reached the limiting dimensions for convenient handling, and if the binding were not so excellent it would hardly endure a twelvemonth's usage. The very large section dealing with "Steam Power," which occupies 245 pages, has been entirely recast and, in great part, rewritten by Dr. T. B. Morley, and some twenty other sections have been revised and extended. There is hardly a phase of engineering practice that is not dealt with in this compendium, which contains a bewildering mass of information in condensed form; one cannot turn over the pages without coming across some item which rivets the attention of the reader. Apart from its advantages to the professional engineer, we wonder whether teachers of engineering in general appreciate the value of this book to their students; as an educational work it is unexcelled by any textbook that we have ever seen. Speaking of textbooks reminds us of a suggestion that we had in mind—that the insertion of short bibliographies, or references to standard works, at the end of each section would take up little space, and would materially add to the value of the Year-Book.

"Marine Wireless Pocket Book," by W. H. Marchant (180 pp.). London: Sir Isaac Pitman & Co., Ltd. Price 6s. net.—In this work is contained a concise description of all the apparatus used in ships' wireless equipments. A very wide field is covered, the systems of various companies receiving full attention. The first part is devoted to power plant. Section II. deals with instruments and apparatus generally, while actual examples are described in Sections III. and IV. The fifth section deals with wave-meters and the measurement of wave-length, inductance, and capacity. A number of useful tables appear. The final section contains regulations, abbreviations, codes, &c., and other general information.

"Model Questions and Answers on the Thermionic Valve," by Clifford Jones (44 pp.). Glasgow: James Munro & Co., Ltd. Price 2s. 6d. net.—This book, as the introduction states, has been compiled for the purpose of assisting students who are studying for the Postmaster-General's first-class certificate. Commencing with the elements of the subject, the work leads up to the use of valves in various connections and different types of construction; it appears to meet the purpose for which it was written in a very full manner.

"Radio Questions and Answers," by Arthur R. Wilson. Pp. 86. London: McGraw-Hill Publishing Co., Ltd. Price 5s. net.—This work is intended to aid students and operators who are about to take the examination for the radio operators' licences issued by the U.S. Government. It is assumed that the reader understands radio operation and theory completely, and the book serves to amplify information on a number of salient points. It deals with the construction and working of apparatus, storage batteries and power plant. An important section is that on "Laws and Traffic Regulations."

"Wireless at Home," by Capt. H. de A. Donisthorpe (46 pp.) London: Percival Marshall & Co. Price 6d. net.—This is an elementary treatise on the subject, written in non-technical language, suitable for those who wish to erect small receiving stations without going too deeply into the subject of "wireless." Apart from describing installations, the booklet also contains a great deal of interesting general matter.

Technologic Paper No. 209 of the U.S. Bureau of Standards, "Thermal Stresses in Chilled Iron Car Wheels" (40 pp. and plates). Washington: Government Printing Office. Price 5 cents.—This describes a method of testing car wheels in the laboratory under conditions approximating to those which are present when brakes are applied on long grades, and for measuring the stresses in the wheels due to the heating of the tread while the hub remains cool.

"Industrial Motor Control," by A. T. Dover. Pp. xii+116; figs. 55. Price 2s. 6d. net.; "Industrial Oxygen," by P. H. S. Kempton. Pp. xii+104. Price 2s. 6d. net. London: Sir I. Pitman & Sons, Ltd.

"An Introduction to the Principles of Industrial Administration," by A. P. M. Fleming and H. J. Brocklehurst. Pp. vii+140, 19 figs. London: Sir I. Pitman & Sons. Price 3s. 6d. net.

"The Outline of Science," edited by Prof. J. A. Thomson; in two vols. Illustrated. London: Geo. Newnes, Ltd.

The A.E.G. in Austria.—The A.E.G., of Berlin, and the A.E.G. Union Electricity Co., of Vienna, are each providing one-half of the capital of a new company with a share capital of 500,000,000 Austrian crowns, under the title of the A.E.G. Union Works, which will take a lease for 30 years of the existing Vienna company's works at Stedlau-Hirschstetten. In future the A.E.G. Union Electricity Co. will act as sales company for the new manufacturing company, and other sales companies, in which the Berlin A.E.G. will have half the share capital, will be formed for the Succession States, Poland and Dantsig, Rumania, and Bessarabia.

A Voltage-Drop Calculator.—MESSRS. DRAKE & GORHAM WHOLESALE, LTD., have produced a useful device for calculating the voltage drop in lines of which the length, area, and current are known. It is in book form, to fit the pocket, and is obtainable from the company for the sum of 3s. 6d.

Sports.—The twenty-seventh annual athletic and cycling tournament, in support of the Dublin United Tramways Employés' Provident Fund, will be held at Lansdowne Road, on Saturday, July 29th.

The Petrograd Accumulator Trust.—Two questions at present constitute the chief care of the Petrograd Accumulator Trust, namely, the supply of the factories with raw material and the settlement of accounts with clients. The supply of the Trust with raw material is the more difficult, as the leading raw materials required before the war were imported almost exclusively from abroad. Such were, for example, chemically pure lead, which it is impossible to obtain in Russia. How far the stocks of lead were reduced can be seen in that during the last four years the former "Tudor" factory obtained no more than 15,000 poods of lead, the "Reks" factory 3,000 poods, and the "Tem" factory 6,000 poods, whereas the normal consumption of one factory alone, the Tudor, amounted to between 6,000 and 8,000 poods of soft lead per month. The reserves of new lead are completely exhausted, and the factories are supplying themselves mostly from old batteries. These are being resmelted; but the material obtained is not suitable to the work it is intended for. Not less urgent is the requirement of the Trust of potash salt, chloride of calcium, &c.

The chief electrical section bought considerable parcels of salts and calcium, namely, 25,000 poods, abroad, and these goods are now in Revel. With regard to lead, the Trust is seeking to work on its own resources. It is proposed to use lead waste found in the factories and to organise the production of small lead. In exchange for this the concern obtains from the Union of Hunters, furs, payable at long date, and it exchanges the furs abroad for soft lead. It is self-evident, however, that to carry on this peculiar combination requires a certain amount of time. To settle accounts with the buyers proves to be particularly difficult for the Trust, as it is working almost exclusively for Government requirements. Sixty per cent. of the orders of the Trust are for the military department, and 40 per cent. for other Government sections. Meantime the buyers have been paying slowly, and the position is further complicated by the fact that even in the best case when a department does pay its account it tenders money with such delay that in view of the rapid decline in the exchange, the full payment of the account to the Trust amounts, in fact, to only a part of the value of the order. In connection with this, the question of credits at the disposal of the various departments leads to the assumption that settlements with the Trust will be made more normal, and so facilitate its operations.

The factories of the Trust are assured of fuel for a considerable time. Besides, this Trust in common with other electrical trusts in Petrograd, shares, in the barter system, with the Petrograd fuel department in the delivery of fuel. As the summer time is the most suitable for working at the factories of the Trust, where a number of the operations are listed as injurious, and much work is done in practically open air, the Trust has decided to work uninterruptedly throughout the summer.

Patents Extension.—A petition has been presented to the High Court by Mr. Charles Smith, of Tynwald, Birdhurst Rise, South Croydon, for the extension of patents granted to him, numbered 16,242 of 1906, and 22,525 of 1907, for inventions and improvements in fire and temperature alarms or indicators, and it will be heard in London on July 4th.

Wolfram Lamp Works.—The rebuilding of the works of the Wolfram Lamp Co., of Augsburg, which was burnt down two or three years ago, was commenced in 1921, and it is expected that production will be resumed by the end of the present year.

British Trade Ship.—We are asked to state that in view of recent announcements of a projected voyage round the world by the steamship *Orontes*, renamed *British Trade*, confusion has arisen between this voyage and that arranged for another vessel under the auspices of British Trade Ship, Ltd., of which Earl Grey is chairman. The *Orontes*, or *British Trade*, has no connection whatever with British Trade Ship, Ltd., whose proposal is to build a special ship for the purpose of an exhibition and send her round the world in 1924.

The Holidays.—The works of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., at Trafford Park and Sheffield, which have been closed from June 1st for the annual holidays, will re-open on the morning of Monday next, June 12th.

Electrical Production in Russia.—According to the accounts and statistical report of the Chief Electrical Section, the concerns engaged in the electrical industry have considerably increased their productivity during the last few months compared with the beginning of the year. Thus, the Volta and Barantche establishments produced electrical apparatus as follows:—In January, to the value of 7,400,000 gold roubles; in February, 11,500,000 gold roubles; and in March, 10,600,000 gold roubles. This has been done with a relatively small increase in the personnel, namely, an increase of eighteen on a personnel of 400, whilst there has been a reduction of 22 hands of the non-labouring class. The production of the "Dynamo" factory shows an increase of 108 per cent. in March over February; whilst the Alexeieff Cable Works produced in March more than double its output in January. The production of incandescent lamps, beginning with last December, has increased steadily in the Moscow factories. In that month the production was 128,000; in January it was 144,000; in February 163,000; and in March 177,000. The position is not so favourable with the Petrograd lamp factory, called the "Svyetlana." There, on the contrary, there has been a decline since December for want of material—particularly bulbs. Data on the Petrograd Telegraph Telephone Trust also shows some decline in the production of Morse instruments, and the Geisler factory discloses a reduction in March compared with February.

For Sale.—By direction of the Disposal Board, Messrs. Geering & Colyer will sell by auction on June 16th, at H.M. Naval Depôt, Dover, electrical equipment, comprising generators, meter and feeder panels, switchboards, electric lighting sets, &c.

By order of the executors of P. F. Huddleston, deceased, Messrs. H. Butcher & Co. will sell by auction, on June 27th, at the Grove Hall, Hammersmith, a quantity of electrical stores and accessories. (See our advertisement pages to-day.)

Safeguarding of Industries Act.—VULCANISED FIBRE.—In response to a complaint from the British Electrical & Allied Manufacturers' Association that vulcanised fibre, manufactured in the United States, is being sold or offered for sale at prices below the British cost of production, the Board of Trade is setting up a committee, under the chairmanship of Sir Bernard Mallett, K.C.B., to investigate and report upon the matter. The secretary of this Committee is Mr. W. W. Hobson, Board of Trade, Great George Street, S.W.1. The first sitting for the taking of evidence is to be held on June 20th at 11 a.m., at 5, Old Palace Yard, Westminster, S.W.1.

A "Rawlplug" Book.—THE RAWLPLUG CO., LTD., has issued, at the price of 1s., an illustrated booklet entitled "Tips on Odd Jobs about the House." This little publication describes the essentials of a complete "handyman's" outfit, and tells the reader how to set about the hundred-and-one tasks which are the natural outcome of living in a house.

Effect of Taxation upon Trade in East and West Africa.—The Federation of British Industries has sent a communication to the Secretary of State for the Colonies, calling attention to the serious effect that the high level of taxation in the British East and West African Colonies is having upon trade between the United Kingdom and these possessions. Representatives of the Federation are to meet the Secretary of State for the Colonies on June 14th, with a view to further discussion on the subject.

C.A.V. Horns.—MESSRS. C. A. VANDERVELL & CO., LTD., announce that, owing to the reduction of costs, due to greatly-increased production, they are now able to reduce the price of their C.A.V. horns. In addition they will shortly have in production brackets that will greatly facilitate the fitting of the horns to the majority of cars by the user himself or by any agent.

LIGHTING AND POWER NOTES.

Barrow.—EXTENSION OF SUPPLY.—At a recent meeting of the Town Council, the Electricity Committee suggested the acceptance of the tender of Messrs. Johnson & Phillips, Ltd., for the erection of an e.h.p. transmission line and l.p. distribution line to Rampside and Roa Island at a cost of £2,816, subject to the Corporation Finance Committee's agreeing to make good annually any loss in connection with the supply up to a maximum of £200 and to the sanction of the Electricity Commissioners being obtained to the necessary loan.

Birmingham.—YEAR'S WORKING.—The accounts of the electricity supply undertaking (Engineer: Mr. R. A. Chattock) for the year ended March 31st last show a total income of £1,041,844, comparing with £1,293,521 in the previous year. Working expenses amounted to £725,042, as against £993,734, leaving a gross surplus of £316,802 (£299,787). This was carried to the profit and loss account, and to it was added £34,661 from reserve as provision for unproductive capital on the Nechells works, and £1,686 bank interest, making a total of £353,149. Against this were charged loan interest, debt

redemption instalments, &c., amounting to £312,391, leaving a surplus of £40,858, as compared with £53,000 in 1920-21. The total number of units sold fell from 136,921,417 to 111,038,406, decreases occurring in all branches of supply. It is of interest to note that the cost of fuel and charges in connection with this, decreased from £415,368 to £262,727, a reduction of nearly 37 per cent., while the falling-off in the sale of energy was less than 20 per cent. Wages and salaries fell from £121,979 to £96,691.

Blackpool.—Year's Working.—The annual report on the year's working of the electricity undertaking for the past year shows a total income of £119,034, as compared with £112,206 in the previous year. Working expenses amounted to £82,294 (£83,321), leaving a gross profit of £36,740. After deducting interest and other charges, there was a profit of £14,322. In the previous year there was a surplus of £8,180.

Brighton.—Price Reduction.—The Town Council is reducing the charges for electricity for lighting from 7d. to 6d. per unit, and from 2¼d. to 1.95d. per unit to the tramways.

Continental.—France.—In the course of their April sessions, the Councils-General of the Côtes du Nord and Morbihan voted participation to the extent of two million francs each in the company which is being formed for the exploitation of a hydro-electric power station to be constructed on the Haut Blavet, twenty km. from Pontivy. An inter-departmental commission, appointed to study the methods by which the scheme is to be carried out, has decided that work on the station is to be begun shortly. Power at 45,000 V will be distributed to the towns of Saint Brieuc, Pontivy, Baud, Lamballe, Dinan, Ploermel, Auray, Lorient, &c. The energy will be supplied at the maximum price of 34 centimes per kWh for h.p. and 40 centimes for l.p. The Commission has decided, in order to prevent the whole of the power being used for industrial purposes, to reserve 25 per cent. for domestic uses and for the driving of farm machinery.—*Reuter's Trade Service* (Paris).

A slight reduction in the price of electricity in Paris is to be made in July (from 98 centimes per kWh to 80 centimes) and a further reduction at the end of the year, when it is hoped that pre-war prices may be reached. If the lower prices for coal persist, the Municipality will be able to make a considerable profit from the working of the city's electricity supply.—*Reuter.*

Italy.—The Società Forze Elettriche Meridionali is about to completely reorganise its plant. The Lago di Santa Croce is to be fed by a supply from the River Piave. The old stations at Fadalto and Nove will be re-equipped as follows:—The former with six sets of 1,500 kW each, generating electricity at 42 cycles; the latter with four sets of 15,000 kW. A new station is now being built at San Floriano which will be equipped with four sets of 1,000 kW, and another, situated on the Livenza, will have three sets of 15,000 kW. The available maximum yield of the four stations will total 200,000 kW.

An Intercommunal Hydraulic Trust has been formed at Tione, in the Valley of Giudicarie, to develop the water-power of the Rivers Sacra and Chiese. Twenty-seven communes of Giudicarie, a number of communes of Lombardy, the commune of Trento, and other public bodies are included in the scheme.

Russia.—It has been decided to improve the electrification of Ruravevki by replacing the 16 small machines already installed by one large one. A special building will be erected for the station. All the work will be carried out by a Moscow trust, and the whole is expected to be finished next autumn.

Denbigh.—Electricity Scheme.—The Electricity Committee has recommended the Town Council to appoint Messrs. Sloan and Lloyd Barnes, consulting engineers, Liverpool, to prepare a scheme for supplying the Vale of Clwyd area with electricity.

Eccles (Lancs.).—Price Reduction.—The Town Council has reduced the increase of 100 per cent. on the standard rates of charge for electricity for lighting, power, heating, cooking, and other domestic purposes by 25 per cent.

Electricity District.—South-West Midlands.—It is announced that the second inquiry in connection with the above-named electricity area which the Commissioners are bound to hold, in accordance with Section 5, sub-section 4, of the Electricity (Supply) Act of 1919, will take place in the Council Chamber, Council House, Birmingham, on June 29th, at 10.30 a.m. The scheme submitted by the Corporation was outlined in our issue of August 5th, 1921, and the Commissioners' inquiry was reported in our issue of November 25th, 1921, and their decision in our issue of March 31st, 1922.

Folkestone.—Extension of Area.—The Electric Supply Co., Ltd., has been granted an order authorising it to supply electricity to Cheriton, Saltwood, Newington, and Hawkinge.

Fife.—Hydro-electric Installation.—The Balgonie Colliery Co.'s hydro-electric undertaking, upon the River Leven at Markinch, was successfully inaugurated last week, the work, which was commenced about a year ago, having been completed in record time. Mrs. Allan, wife of Mr. J. S. Allan, one of the directors of the company, performed the opening ceremony by starting up the turbines. The colliery officials were congratulated on their enterprise in developing the water-power available. Mr. Webster represented the firm of Messrs. James Gordon & Co., Ltd., London, who supplied and erected the turbines. Electricity is now being utilised throughout the whole coalfield for various purposes in connection with the mining operations.

Haslingden.—Price Reductions.—The Corporation is reducing the charges for electricity for lighting from 7¼d. to 7¼d. per unit and for heating from 3d. to 2¼d. per unit. The increase of 120 per cent. on pre-war rates to ordinary power users is being reduced to 100 per cent.

Hornsey.—Extension of Supply.—Application is being made to the Electricity Commissioners for an Order permitting the Council to supply certain works in Friern Barnet with electricity. The proposed scheme has been approved by the Friern Barnet Council and the North Metropolitan Electric Power Supply Co., Ltd.

Japan.—"Super-power" Scheme.—Developments in Japan within recent months indicate the future possibility of a super-power system to furnish electricity over the large area between Tokyo and Osaka. The completion of the contemplated programme will give this Far Eastern nation one of the largest, if not the largest, super-power systems in the world. The principal industries in Japan are situated along the south coast of the Island of Nippon, the largest island of the Japanese group, and more especially around Tokyo and Osaka, and, to a lesser degree, Nagoya. To the north of Nagoya and approximately half way between Osaka and Tokyo, the rough and somewhat sparsely populated provinces of Shinano and Mino are particularly rich in water-power, which is capable of development at such a cost as to make transmission to both Osaka and Tokyo an economical proposition. The chief rivers in this district are the Kiso and Tenryu rivers, flowing south into the Pacific Ocean, and the Shinano river, flowing north into the Sea of Japan. These rivers, especially the Kiso and its tributaries, have already been utilised for power purposes to a certain extent, but it is planned to obtain from them within the next few years an additional half-million kW.—*Indian Engineering.*

Kendal.—New Plant.—The Town Council has decided to expend £11,655 on new plant and cables in connection with the electricity undertaking.

Leek.—Price Reductions.—The Council is reducing the charges for electricity for lighting to 7¼d. per unit and for cooking and heating to 2¼d. per unit, with a minimum half-yearly charge of 15s.

Rate Relief.—The Electricity Committee has handed over £1,500 from the profits of the year's working of the electricity undertaking towards the relief of the rates.

Liverpool.—Transfer of Bootle Undertaking.—With a view to avoiding a public inquiry, negotiations are in progress between the Corporation and the Councils of Bootle and Litherland regarding the terms of the transfer of the Bootle electricity undertaking to the City. The proposed charge for domestic lighting is 1¼d. per unit in advance of the charge within the city, with a maximum of 9d. per unit. If, however, the Liverpool charge be reduced, the charge to the urban districts will be reduced proportionately.

London.—St. Marylebone.—The Borough Council has received sanction from the Electricity Commissioners to a loan of £7,818, part of £11,139 applied for by the Council, for additions to the plant at the electricity works. The Electricity Commissioners have deferred consideration of the application to borrow the balance of £3,321 for cable and switchgear in connection with the supply to Hampstead, pending the conclusion of the agreement with the Hampstead Borough Council.

Mullingar.—Electricity Scheme.—A scheme has been submitted to the Town Commissioners by the Mullingar Motor Co. for the lighting of Mullingar with electricity.

Navan.—Loan.—The Local Government Department of the Irish Provisional Government has sanctioned a loan of £12,000 in connection with the proposed public electric lighting scheme.

Nuneaton.—Year's Working.—The annual report on the electricity undertaking for the past year shows a net profit of £2,091.

Preston.—Price Reductions.—The Town Council has reduced the charges for electricity for lighting by allowing 10 per cent. discount for cash in three weeks, and for power the discount of 5 per cent. has been increased to 15 per cent.

Rochester.—Price Reductions.—The Kent Electric Power Co. is reducing the charge for electricity in Rochester and Chatham for lighting to 10d. per unit for the first 400 units per quarter, and 7½ beyond; and for power from 4d. to 3½d. The reductions are to take effect as from July 1st.

South Africa.—Electricity Bill.—The Government's Electricity Bill, which provides for the creation of a Commission empowered to raise capital and erect power stations at suitable centres, was read for the second time on May 31st in the Union House of Assembly, and was then referred to a Select Committee.—*Reuter* (Cape Town).

Walsall.—Year's Working.—There was a profit of £1,100 on the electricity undertaking during the year ended March 31st last, as compared with a profit of £1,614 in the previous year.

Worcester.—Year's Working.—The report upon the city electricity undertaking (Engineer: Mr. C. M. Shaw, M.I.E.E.) for the year ended March 31st last, shows a total revenue from all sources of £46,906, comparing with £41,179 in 1920-21. Working costs amounted to £33,148, as against £27,236, leaving a gross profit of £13,758 (£13,943). Loan interest, sinking fund, taxes, and other capital charges absorbed £12,412, leaving a net profit of £1,346 (£2,323). A sum of £333 was spent out of revenue as capital expenditure, and £1,500 was contributed in aid of rates. The total number of units sold increased from 3,663,349 to 4,583,621. In his report the electrical engineer shows that by purchasing second hand plant from Southampton a saving of £50,000 has been effected. He suggests that, consequent upon the fall of the price of fuel, the following reductions in charges should be made:—Lighting, ordinary rate from 7½d. to 7d. per unit, rateable value system (charge per unit) from 1d. to ¾d., with reductions in special contract rates; heating, from 1½d. to 1¼d. per unit; power, basic scale to remain unchanged, but additional charge reduced from 75 to 60 per cent.

York.—Loan.—The Electricity Committee has recommended that the City Council apply to the Electricity Commissioners for sanction to borrow £1,200 for two air filters; £2,000 for transformers; £3,000 for services; and £720, being the amount in excess of estimated cost of works at the Linton Locks station.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—Year's Working.—The result of the year's working of the tramway undertaking for the past year shows a profit of £6,142, as compared with £144 in the previous year.

Continental.—Switzerland.—The electric railway between Lucerne and Goldau, which was completed recently, has now been opened, the first train travelling the distance, with three stops on the way, in 32 minutes.

Italy.—At a meeting of representatives of the administration of the province and the communes of Ancona, Osimo, Castelfidardo, Camerono, Montesicuro, Loreto, Recanati, and Falconara, it was decided to instruct an engineer to prepare plans and estimates for an electric railway to link up the communes named and eventually to serve adjacent districts in the province. On completion of these preliminaries, application for a concession will be made.

Dewsbury.—Extension of Time.—The Town Council is applying for an extension of the time allowed for the construction of tramways to Dewsbury Moor and Shaw Cross and across the Market Place.

Halifax.—Reconstruction.—The Tramways Committee has given the general manager authority to carry out during the next five years reconstruction and repairs to the permanent way, rolling stock, and overhead line equipment, at an estimated cost of £56,914; and points and crossings, £10,000.

London.—The "Underground" Extensions.—A number of contracts have now been placed for the extension and improvement of the Underground railways, the funds for which have been guaranteed by the State. The line from Golders Green to Hendon (1¼ miles) is to be constructed by Messrs. Charles Brand & Son, of London. The extension connecting Euston (City & South London Railway) with Camden Town (Hampstead line) is to be carried out by Messrs. John Mowlem & Co. The Metropolitan Tunnel & Public Works Co., Ltd., Messrs. Perry & Co., Ltd., and Messrs. Charles Brand and Son have each received a contract for the reconstruction of parts of the City & South London Railway. The whole of the existing rolling stock on this line is to be replaced by modern stock, and the stations will be rebuilt upon the lines adopted on the Bakerloo, Piccadilly, and Hampstead lines. The value of the contracts thus placed is about £1,000,000, and further contracts are the subject of negotiations.

Hammersmith.—On the 1st inst. a L.C.C. tramcar left the rails at the corner of King Street, and ran into the shop-front of a firm of milliners, doing considerable damage. Fortunately the car had only just left the depôt and only contained one passenger. No one was injured.

Oldham.—Penny Fares.—The Corporation Tramways Committee has decided to reintroduce the penny fare, with the proviso that whereas the first stage for passengers on any part of the system shall be one penny, the charge for each subsequent stage shall be a halfpenny.

Walsall.—Year's Working.—The year's working of the tramway undertaking during the past year resulted in a net profit of £3,987.

TELEGRAPH AND TELEPHONE NOTES.

Italy.—Wireless Concessions.—A commission consisting of five or six wireless experts is about to be nominated by the Italian Government to proceed to Nauen and Carnarvon to make a minute examination of these stations, with a view to guiding the Government in questions relating to the granting of wireless concessions.

A lively discussion has been going on in the Italian technical and daily Press lately as to the system to be set up in that country when the Marconi concession is withdrawn. It is strongly held in some quarters that the Telefunken system is superior to the Marconi, while the ability of Italian manufacturers to supply "radioelectrical material of first quality *up to* 10 *kW*," is vouched for by our contemporary, *L'Audion*.

According to the Minister of Telegraphs, the wireless message traffic in Italy had increased from 700,000 words in 1919 to 4,834,000 words at the end of last year. A decree will shortly be published allowing telephone subscribers to alternatively make use of wireless telephony or wireless telegraphy for the forwarding of their messages. Freedom for the use of private wireless apparatus would also be granted.

Wireless Telegraphists.—The recall of the Marconi wireless staff serving aboard Italian ships has created a serious difficulty for shipowners, and was considered at a meeting held lately at Genoa. It was decided to draw up a list of suitable operators, to which shipowners might have resort, instead of engaging, as had happened recently, partly qualified men fortuitously met with.

Automatic Telephones.—The automatic telephone system is to be introduced into Turin. It is proposed to set up five automatic stations, the largest, for 10,000 subscribers, being built in the middle of the city, and four sub-stations, in the suburban districts of Milano, Borgo Po, Nizza, and Borgo S. Paolo respectively.

New German Atlantic Cable.—A general meeting of the German Atlantic, German South American, and East European Telegraph Companies has decided upon a fusion of these companies. This will enable the new telegraph concern to carry out the construction of a cable from Emden to the Azores, to connect with the cable from New York to the Azores of the Commercial Cable Co. of New York.—*Reuter* (Berlin).

Proposed New Pacific Cable.—It is announced that the directors of the Pacific Cable Board will meet shortly in London to decide on the laying of a second cable between the Province of British Columbia and Australia, and that the new cable may possibly follow a different route from that followed by the present line.—*Reuter* (Victoria, B.C.).

Rapid Cable Service.—A Transmission Record.—The Eastern Telegraph Co. accomplished a remarkable achievement in the cabling of the result of the Derby. They received the names of the three winning horses at 3.24½ p.m. at their offices in Electra House, and telegrams recording this result were delivered in Bombay at the local equivalent of 3.26 p.m. London time; in Sydney at 3.27 p.m.; in Durban at 3.26 p.m.; in Calcutta at 3.30 p.m. It must, of course, be understood that owing to the immense interest created by the race all over the world, special arrangements were made to clear the lines.—*Reuter*.

South Africa.—"Broadcasting" Offer.—The Marconi Co. has offered the Government a scheme for broadcast wireless telephones throughout the Union, the cost of which would be recouped by the sale of receiving instruments, at from £5 to £10, or "*de luxe*" sets at £30. It is considered that the scheme will prove to be a valuable educative influence on the veld.—*African World*.

Telephone Service.—Tube for Telephone Cables.—Substantial economy is expected by the Postmaster-General to result from the acquisition of the underground tube of the Pneumatic Despatch Co., Ltd., which runs from the General Post Office east to a point near Euston station. By the Bill now before Parliament effect will be given to the agreement of December 30th last, under which the company agreed to sell the undertaking to the department. The tube is to be used for the accommodation of telephone cables, and the estimated saving by placing the cables in the tube, as compared with the cost of laying ducts below the public thoroughfare, is about £40,000 at current prices. The use of the tube has the additional advantage of avoiding the dislocation of street traffic which would be involved by the excavations required for the laying of ducts.—*Daily Telegraph*.

Wireless Telephony.—Broadcasting.—In a recent interview, Mr. Kellaway said that, in order to settle the question of the dissemination of matter by "broadcasting" from the proposed stations, he had decided to call a conference of Press and news agency representatives and the firms interested in the erection of the stations. No doubt strict regulations would have to be framed, but these could be lifted as experience dictated.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia. — Melbourne. — October 17th. Postmaster-General's Department. Supply of automatic switchboards and associated apparatus for two suburban exchanges at Melbourne.

June 17th. Aluminium steel-cored cable and accessories. (Spec. No. 243.) (May 26th.)

Queensland (Bowen).—June 30th. Municipal Council. Electric power generating plant, switchboard and other equipment.

Perth (W.A.).—July 26th. Postmaster-General's Department. Telegraph and/or telephone apparatus, testing instruments, protective apparatus (sched. 734). (See this issue.)

Belgium.—June 24th. Municipal authorities of Ixelles, Brussels. Supply of electricity meters.

June 30th. Municipal authorities of Romsée (Province of Liége). Establishment of a system of electricity supply in the town.

Bulgaria.—Sofia.—June 15th. Post and Telegraph Department. Fuses, line annunciators, and lightning arresters.*

Dublin.—June 12th. Dublin United Tramways Co. (1896), Ltd. Six months' supply general stores, including electrical supplies, &c. (June 2nd.)

Edinburgh.—June 12th. Electricity Department. Underground insulated cables. (June 2nd.)

June 20th. Tramways Committee. Supply of 30 car top covers. Manager Tramways Department.

Glasgow.—June 12th. Clyde Navigation Trustees. Stores (including electrical stores) for three, six, or twelve months. Superintendent of Stores, Govan.

India.—June 23rd. High Commissioner's Department. Switchboard cable and cable for wiring buildings, dry core lead-sheathed and armoured cable, and lead-sheathed unarmoured submarine cable. (June 2nd.)

Limerick.—June 12th. The Administrator of St. John's Cathedral. Wiring and fitting for electric lighting the Cathedral and Presbytery at Limerick. Specification (£2 2s.) from the consulting engineers, Messrs. J. P. Tierney & Co., 44, Kildare Street, Dublin.

London.—Metropolitan Asylums Board.—June 21st. Installation of forced circulation heating and hot-water supply apparatus, &c. Installation of electric lighting and power, telephones, fire alarms, and domestic bells. (May 26th.)

St. Pancras.—June 15th. Electricity Department. Two sets of motor-generator balancers, each of 1,000 kW; l.p. cables. (June 2nd.)

L.C.C.—July 15th. Wiring of the buildings, motors, telephones, and supply and fixing of overhead electrical conductors and main cables, switchboards, &c., at the Eleventh Mental Hospital, Epsom. (See this issue.)

Maidstone.—June 30th. Kent County Mental Hospital. Two 3-phase back-geared electric motors, two centrifugal pumps and accessories, main switchboard, starting and controlling gear and wiring. (May 26th.)

Manchester.—June 13th. Electricity Committee. Electrical distance indicating and recording thermometers, fans, auxiliary circulating water pumps, electric capstans and bollards. (May 26th.)

June 15th. Electricity Committee. Cable requirements for six months. Mr. F. E. Hughes, Electricity Department, Town Hall, Manchester.

June 13th. Tramways Committee. Supply of electrolytic copper and silicium bronze trolley wire, pitch, &c. Mr. J .M. McElroy, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

June 28th. Electricity Committee. Installation and connection complete of the subsidiary cables between generators, auxiliaries, transformers, and switchboards in the Barton power station, with materials for fixing tail end boxes and pot-heads for all the cables scheduled. (June 2nd.)

Middlesbrough.—June 26th. Town Council. Construction of double line of tramways. Borough surveyor.

Portsmouth.—June 13th. Tramways Committee. Stores (including insulating material, lamps, and motor windings, &c.) for six or twelve months. (June 2nd.)

Preston.—June 28th. Electricity Department. E.h.p. switchgear. (June 2nd.)

Reigate.—June 27th. Town Council. Diesel engines and single-phase alternators, complete with accessories, two steel oil storage tanks, one 12-ton overhead electric travelling crane, alterations to existing cast-iron water tank. (See this issue.)

Salford.—June 15th. Electricity Department. Two 10,000/12,000-kW turbo-generator sets with condensing plant, and other equipment. (May 26th.)

South Africa.—Frankfort, Orange Free State.—The Municipality is inviting tenders for a hydro-electric scheme. Particulars from the consulting engineer, Mr. W. Ingham, 101, Consolidated Buildings, Fox Street, Johannesburg.

Grahamstown, Cape Province.—September 1st. Power plant, alternators, switchboard, transformers, cables, &c. Specifications from Mr. F. G. Clarkson, town clerk.*

Caledon, Cape Province.—August 9th. Municipal Council. Electric lighting installation. The specification has been drawn up by Prof. Bohle, of the University of Cape Town.

Johannesburg.—June 29th. Municipal Council. Metal filament lamps:—5,000 210 V, 60 watt; 4,000 ditto, 100 watt; 1,000 ditto, 20 watt; 5,000 240 V, 60 watt; also cast-iron street lighting suspension fittings.*

Southend-on-Sea.—Electricity Department. One 480/550 V, d.c. generator, with 500/550 shunt regulator, to be direct coupled to a prime mover; also one 480/550-V, d.c. generator, 600/650 kW, to be direct coupled to a prime mover, both generators to be of the multi-polar type. (See this issue.)

Tynemouth.—June 26th. Electricity Department. A.c. booster. (June 2nd.)

West Ham.—June 13th. Electricity Department. One 10,000-kW turbo-generator, one 10,000-kW surface condensing plant. (May 26th.)

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Aberdeen.—Electricity Committee. Accepted:—

Steel work for the first section of the new boiler-house at the electricity works, Ferryhill (£8,113).—Steel Construction Co., Ltd.

Barrow-in-Furness.—Electricity Committee.

Erection of e.h.p. transmission line and l.p. distribution line to Rampside and Roa Island (£2,816).—Johnson & Phillips, Ltd.

Belgium.—Four concerns recently submitted tenders to the municipal authorities of Liége for the supply of a quantity of armoured cable required in connection with the electricity supply undertaking. The lowest offer submitted (291,665 fr.) was that of the Kabel und Draht Gesellschaft, of Vienna.

Bray (Co. Wicklow).—Urban Council. Accepted:—

Diesel engine and alternator for the electricity works (£5,233) (a reduction of £1,370 on the price quoted two years ago).—Mirrlees, Bickerton and Day.

Dublin.—Electricity Committee. Accepted:—

Two water-tube boilers for the Pigeon House station (£35,533).—Babcock and Wilcox, Ltd.

Halifax.—Tramways Committee.

One group feeder equipment and control panel (£945).—British Thomson-Houston Co., Ltd.
Nine e.h.p. switch panels (£3,100).—A. Reyrolle & Co., Ltd.

Navan.—Town Council. Accepted:—

Electric lighting scheme:—Turbines, at £2,983, with £280 for erection.—Hay, Maryon & Co.
136 poles (£616).—The British Mannesmann Tube Co.

York.—Electricity Committee.

Rotary converter, switchgear, &c. (£2,753).—British Thomson-Houston Co., Ltd.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Monday, June 12th, to Wednesday, June 21st. Paris and Liége Summer Meeting.

Society of Engineers.—Monday, June 12th. At Burlington House, Piccadilly, W. At 5.30 p.m. Papers on "The Physical Properties of Clay," by Dr. H. Chatley and Mr. A. S. E. Ackerman.

Roentgen Society.—Tuesday, June 13th. At the Institution of Electrical Engineers, Victoria Embankment, S.W. At 8.15 p.m. Annual general meeting.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of suppliers or manufacturers of:—

An electrical device for extracting nails from packing cases.

Beaver brand electric iron attachment.

NOTES.

The Lock-out.—The result of the pooled vote of the 47 unions was made known on Friday last. The voting was 99,313 for the acceptance of the modified terms submitted by the Employers' Federation, and 46,881 against—majority for settlement 52,432. It is said that arrangements were being made for the return of men to work on Tuesday, or as soon thereafter as possible. At the York conference of the A.E.U. delegates, some 500 of whom were present, Mr. J. T. Brownlie made a full statement regarding the course of the negotiations, and the secretary gave an account of the financial position of the union. The result of the voting of the other unions was received while the afternoon meeting was in session. It was resolved to submit the employers' proposals to a ballot vote of the membership, the president expressing the hope that they would receive the most earnest consideration having regard to the importance of maintaining the organisation intact. The extremists met with overwhelming defeat at York. In a letter addressed to the members Mr. Brownlie strongly recommended acceptance of the proposals, thus bringing the lock-out to a speedy termination, maintaining the A.E.U. organisation intact, enabling members to return to work, thereby assisting to stimulate a revival of the engineering industry and find employment for unemployed members of the union. In the course of his letter Mr. Brownlie said :—

"The fact that the employers are called upon to give at least ten days' notice of any change that is calculated to result in the displacement of one class of workpeople by another is an important concession, and should not be overlooked. The employers' proposals are procedure only, and do not affect wages or working conditions, which must be negotiated separately, in accordance with the Provisions for Avoiding Disputes.

"The employers' proposals may be distasteful to a large section of our membership, but I would remind those who think so that the said proposals are mild in comparison to the terms of settlement imposed upon the engineering unions at the end of the great lock-out in 1897-8, when many of us thought that the 'terms of settlement' were 'the end of all things,' so far as engineering trade unionism was concerned. Many of us thought at that period the terms of settlement crippled beyond recovery the activities of our organisation, but subsequent events falsified our prognostications, as during the period in which we recognised procedure for avoiding disputes the members of the engineering unions gained concessions of greater value, in comparison, than any concessions obtained during the preceding twenty-five years, without having recourse to drastic action."

One newspaper report states that though only half of the total membership of 400,000 in the A.E.U. has been idle, the dispute has cost £700,000, and there is a large financial deficiency.

It seems that the boiler-makers' vote against acceptance was a very heavy one. Both they and the foundry workers stood aside from the pooled vote. The action of the boiler-makers is not likely to be definitely settled until the A.E.U. ballot result is known. It is hoped, however, that not many weeks will elapse before the shops are running at full speed again, enabling the engineering industry to regain some of the ground that has lately been lost.

Accident.—A serious accident occurred to A. Sales, of the Tunbridge Wells Corporation electricity department, on May 26th. The injured man was carrying out some repairs on a high-pressure cable, standing upon a wet floor. He slipped, and in falling seized the cable, receiving a shock of 2,000 V. His cries attracted the attention of the assistant chief engineer, who put on rubber gloves and dragged Sales away. The latter was unconscious, but by means of artificial respiration he was brought round, and was removed to hospital. His right leg was burned, and his left hand was also blackened, and some fingers were destroyed.

Appointments Vacant.—Assistant meter and testing engineer (400 taels per month); meter department assistant (300 taels per month) for the Shanghai Municipal Electricity Department (tael=3s.). (See our advertisement pages to-day.)

Fatality.—While at work on a pumping installation at the bottom of the shaft of the Manners Colliery, Derbyshire, Joseph Houlden received a fatal electric shock.

Electric Vehicles in Municipal Service.—According to the *Commercial Motor*, there are now over 100 municipalities in Great Britain using electric vehicles, principally for refuse collection and cleansing. The approximate numbers of each make employed are as follows :—Edison, 234; Orwell, 120; General Vehicle, 60; Garrett, 33; Electromobile, 27; Newton, 10; and Cedes, 17. In general, municipal work involves innumerable starts and stops in relatively small mileage, and for such cases no vehicle possesses better qualities than the electric. Its ease of control, lack of shock at starting or stopping, and the absence of power consumption when standing, all combine to make it the most suitable type of vehicle for municipal purposes.

United States Electric Vehicle Market.—Business in the electric vehicle market is rather quiet. According to a semi-official announcement, the electric truck business in the Metropolitan district during the past five months shows a gain of 300 per cent., as compared with the corresponding period of 1921. The Autocar Co., of Ardmore, Pa., makers of a well-known gasoline truck, is about to enter the electric truck manufacturing field. The Electric Vehicles Bureau of the New England Division of the National Electric Light Association held its first big meeting at Boston on May 24th, which was attended by more than 200 executives and others connected with the electric truck and allied interests. Various phases of the industry were discussed, and it was decided to hold similar gatherings monthly. A proposal to hold the first Electric Automobile Show in Boston in the autumn was favourably received, and plans will probably be submitted at the next meeting.—*Reuter's Trade Service* (New York).

Iron Losses.—Mr. Waldo V. Lyon, Assistant Professor of Electrical Engineering at the Massachusetts Institute of Technology, has written an important and interesting paper on the problem of determining the eddy-current and hysteresis losses in relatively thin iron plates. The solution is usually obtained on the assumption that the ratio between the instantaneous value of the magnetising force and the magnetic flux density is a constant. The hysteresis loop is therefore a straight line. The author does not make this assumption. He assumes that the hysteresis loop is an ellipse, and so his results can take into account the hysteresis losses. He can also use vector diagrams. Simple formulæ are thus obtained which we expect will be found useful in practice.—*Faraday House Journal.*

The Neon Lamp "Blink."—Messrs. S. O. Pearson, B.Sc., and H. St. G. Anson gave an interesting demonstration of some novel properties in connection with neon gasfilled lamps to the Physical Society on May 12th. Mr. Anson discovered that when a neon gasfilled lamp was shunted by a condenser and a resistance was put in series with the combination, then the light given by the lamp "blinked" with constant frequency. By varying the condenser in parallel and the resistance in series, they were able to vary the frequency from a "blink" every 10 minutes to 15,000 "blinks" per second. They demonstrated the existence of these interruptions of the current by means of a loud speaking telephone. The notes started at intervals of seconds and then the frequency was increased until ultimately it became inaudible at the highest frequency. The frequency in this case was measured by means of the heterodyne method used in radio-telegraphy. Mr. Pearson showed how the frequency might be found approximately by mathematical calculation. The paper excited much interest as it was at once recognised that the phenomenon could be utilised for various commercial and scientific purposes. —*Faraday House Journal.*

A reader has noticed a curious phenomenon in connection with the neon lamp. He has one of these on a two-switch circuit, fed with alternating current at 205 volts, 50 cycles. When switched on, the lamp glows in the ordinary way, but when it is switched off it is not extinguished; it continues to glow faintly. Apparently the capacity of the two switch wires lying side by side for a distance of some ten feet suffices to allow a small capacity current to flow round the circuit. On bridging the switch terminals with the finger and thumb, the lamp lights up almost fully, without causing appreciable discomfort to the experimenter.

French Congress.—An international congress on the applications of electricity is to be held during the Exposition Coloniale at Marseilles from the 17th to the 20th of the current month. The congress is divided into six sections: (1) Production and Transport of Energy; (2) Electric Traction; (3) Electricity in the Household; (4) Mechanical Applications of Electricity; (5) Wireless and other Electrical Means of Communication; and (6) Electro-Chemistry and Electro-Metallurgy. Particulars as to lodgings, forwarding of machinery, &c., may be obtained of the President du Groupement Régional de la Houille Blanche, Marseilles; and purely technical particulars of the Directeur de l'Institut Electrotechnique de Grenoble (Isère).

The Electrical Trades Benevolent Institution.—The Institution has published from its offices at 18 & 21, Park Mansions, South Lambeth Road, S.W.8, a booklet containing the report of the Committee and accounts for 1922; a report of the annual general meeting, 1921; a report of the annual festival, 1921; a list of governors, members, subscribers, and donors, and the rules of the Institution.

German Industrial Conditions.—The *Bulletin* of the F.B.I. quotes a correspondent in Germany to the effect that complaints are made by engineering manufacturers of insufficient stocks of raw materials and fuel. Advances in freight rates, wages, prices of coal and raw materials, particularly pig iron, have necessitated a corresponding increase in all selling prices. Cast-iron rose by one-third. According to Chamber of Commerce reports quotations of German locomotive manufacturers have reached the world level or even higher. In the electrical supplies industry orders have been plentiful, particularly from industrial undertakings which are anxious to utilise the present high profits in installing the latest improvements before conditions become less satisfactory.

Accident at Niagara Power Station.—On April 20th a serious accident occurred in the plant of the Ontario Power Co., of Niagara Falls, which is part of the system of the Hydro-Electric Power Commission of Ontario. In this plant there are installed 16 sets having an aggregate capacity of 200,000 h.p. It is reported that four 16,000-h.p. and two 20,000-h.p. sets were involved, the latter two being wrecked and the other four damaged by water. When part of one of the 20,000-h.p. generators was hurled through the roof, the covering over these two machines fell and caused the turbine casings to fail. The Johnson valves in the turbine penstocks were closed as soon as possible, but in the meantime the water flooded four more machines.

As far as can be learned, the contributory cause of the mishap was a short-circuit somewhere on the line of the Hydro-Electric Power Commission. The sudden dropping of the load caused the machines feeding the line to speed up. At that time four sets in the power house of the Canadian Niagara Falls Power Co. rated at 10,000 h.p. each, were running in parallel with the generators in the Ontario Power Co.'s station. When the operator in the Canadian Niagara station saw the four machines speeding up, he pulled over the rheostats as far as they would go in an effort to cut down the voltage. This, however, had no effect, and when it was discovered that the sets were being driven as motors by the larger generators in the Ontario Power Co.'s station, the feeder switches were opened and the Canadian Niagara units cut off the line. Shortly afterwards one of the 20,000-h.p. sets in the Ontario Power Co.'s station failed.

The destroyed end of the power-house, with its equipment, was erected by the Hydro-Electric Commission of Ontario during the war to meet the great demand for power at that time. This increased the total capacity of the station from 160,000 h.p. to 200,000 h.p. The waterwheels were built by S. Morgan Smith Co., and the generators by the Canadian General Electric Co.—*Power.*

Tenacity of Conduit Grips.—The accompanying illustration shows the result of a test upon a length of ¾-in. conduit, to each end of which was fitted a "Broadbent" improved patent grip tee piece (Broadbent's Patents Co. (Southport), Ltd.). The grip is obtained by the application of

TENACITY OF CONDUIT GRIPS.

a collar, having an elliptical hole, over two lugs and giving it a turn, the smaller diameter presented to the lugs causing the collar to hold tight. It will be seen that while the conduit was badly twisted the tee pieces remained in position.

Brass Casting Research.—The British Non-Ferrous Metals Research Association, 71, Temple Row, Birmingham, has carried out an extensive research on the influence of gases on high-grade brass. A further investigation is now being started by the Association at the Research Department, Woolwich, in which the support of the Engineering Co-ordinating Board of the Department of Scientific and Industrial Research has been secured. The prime object of the present work is to study the conditions necessary for securing both surface and internal soundness of strip brass ingots, such as are required for cold rolled sheet metal. The investigation will throw much light on other types of casting in non-ferrous alloys and should interest a wide circle of manufacturers in the metal and engineering trades. Dr. Harold Moore, O.B.E., and Mr. B. Genders, B.Met., who have already been engaged successfully on similar work, will have charge of the research, which will be conducted partly in the works of members of the Association, and partly in the Woolwich laboratories.

Licensing and Inspection in Quebec.—The Provincial Government has decided to put into immediate effect the law of 1921, which provides for the licensing of electrical contractors and journeymen, and for the inspection of electrical installations. A board of examiners will be appointed, consisting of three competent electricians, with at least five years' experience of electrical work. There are to be five classes of licences, covering individual contractors, contracting firms, journeymen, kinema operators, and persons employed in public buildings who are not electricians but capable of performing small electrical repairs. At present the Act only applies to public buildings, but the interpretation of this term is a wide one, including, as it does, hotels, boarding houses, hospitals, churches, &c.

Low-temperature Carbonisation.—The various views put forward at the conference held recently by the South Wales Institute of Engineers regarding low-temperature carbonisation were thus summarised in the *Manchester Guardian Commercial*: It is not easy to give an exact definition of the term "low-temperature carbonisation" of coal. High-temperature carbonisation consists in heating raw coal in closed retorts or ovens at about 1,600-2,000 deg. F. In the gasworks process the main object is the production of as much gas as possible, and in the coke oven to obtain a hard metallurgical coal. Both these processes result in the decomposition of a large portion of the volatile matter of the coal into gas. The object of low-temperature carbonisation may be said to be to obtain the maximum yield of valuable liquid products from the volatile matter, to reduce the gas yield to a minimum, and to obtain a residual fuel which, while being smokeless, like coke, will be easily ignited and suitable for a household fuel. Dr. Lander, of the Fuel Research Board, gave as his opinion that the answer to the question: "Will it be possible to establish on sound industrial lines a new industry based on the carbonisation of tens of millions of tons of coal per annum?" was that the knowledge and experience which had been gained as the result of much patient work during the past few years had brought the answer almost within reach. If the problems of low-temperature carbonisation are solved it means a revolution in industry. Great Britain raises 250,000,000 tons of coal per annum and consumes at home 187,500,000 tons, of which 20,000,000 tons is used for coke ovens and 18,000,000 tons for gasworks. If the remaining 149,500,000 tons was submitted to low-temperature carbonisation we should have available about 500,000,000 gallons of motor spirit (more than twice our consumption of petrol), 75,000,000 barrels of oil, and 1,350,000 tons of sulphate of ammonia. The total national saving would be over £250,000,000 per annum, including the complete abolition of black smoke and practical independence of the rest of the world for liquid fuel and fixed nitrogen.

Ireland's Water Resources.—A lecture on "The Water Power Resources of Ireland" was delivered some time ago before the members of the Dublin Royal Society by Sir John Purser Griffith, who was Chairman of the Irish Sub-Committee of the Committee appointed by the Board of Trade in 1918 to investigate the water-power resources of the United Kingdom.

Sir John prefaced his address by an account of the circumstances which led to the nomination of the Committee and by an historical survey of previous similar inquiries. The utilisation of water power was no new question in Ireland, he proceeded, but it had taken on an altogether new significance because through electricity it was not obligatory to use it at the point of creation. It was calculated that the power derivable from Ireland's water resources was equal to 500,000 continuous h.p.

The Sub-Committee had confined its investigation of resources to the Shannon, Erne, Bann and Liffey rivers. The Shannon offered great facilities for the production of cheap power. The physical difficulties were limited, and a scheme could be devised that could be carried out piecemeal as demand increased. For an outlay on 1919 prices of £2,834,000 installations capable of producing 52,500 h.p. could be erected. The Erne presented more obstacles, and drainage and navigation interests conflicted, but a feasible scheme costing £2,060,000 would yield 45,500 h.p. The Bann offered a restricted problem. Most of the interests on the river were milling, and it was considered that plant developing about 12,000 h.p. could be provided that those interests alone could make full use of at ½d. per unit.

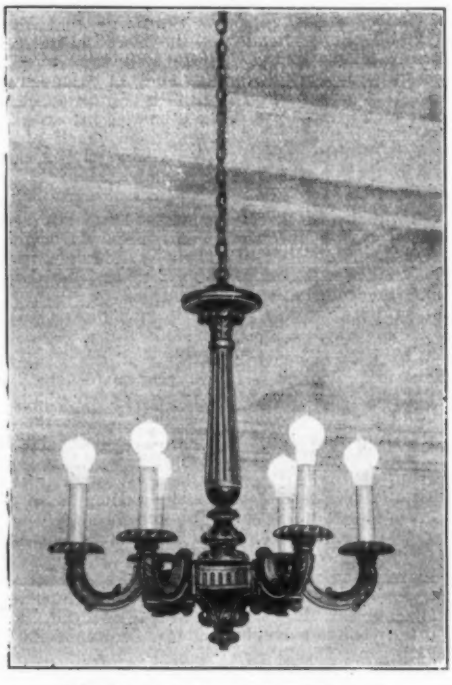
The Liffey was full of great possibilities, and engineers reckoned that the river was capable of producing 10,000 h.p. continuously. A scheme for its utilisation costing £1,213,000, including the expense of transmission lines and transformers, would easily supply the whole of the Dublin district with all the power it wanted. The scheme, remarked Sir John, was one of the most attractive he had met with. The source of the necessary power was close to their doors, the market was at hand, the need was great, and as an economical proposition it could not, in his opinion, be challenged.

In conclusion, the lecturer drew an interesting comparison between Ireland and Switzerland in the need for and the use of cheap electric power. Both countries were largely agricultural and destitute of coal, but, whereas Switzerland had now so utilised its water resources that practically every domestic and national industry benefited, Ireland had still to make proper use of its rivers and lakes. Now, however, it could proceed to develop them to the best advantage if it had the experience of Switzerland, America and Germany to guide it and to teach it what mistakes to avoid.—*Financial Times.*

Electric Ship Trials.—In the completion of the conversion of the United States Shipping Board steamship *Victorious* to electric drive and her highly-successful trial run, the Tebo plant of the Todd Shipyards Corporation has made an important contribution to what may one day be the universally adopted method of ship propulsion. The Tebo plant had already converted to electric drive the Shipping Board steamships *Invincible*, *Independence*, and *Archer*, and the performance of the *Victorious* evoked high commendation from the engineers and naval architect who attended the trial. The trial run of the *Victorious* took place off the Jersey Coast and

extended over a period of five hours. The contract speed of the vessel with the original geared turbines was 10 knots. With the new equipment she was to have equalled this speed, but during the trials she attained a speed of 11.6 knots. One of the outstanding features of the trials was the marked ability to stop. The propeller was reversed from full speed of 100 revolutions per minute ahead to full speed astern in four seconds, which brought the vessel to a dead stop in two minutes and forty seconds. A similar vessel with reciprocating engines would require more than six minutes to perform the same feat. The quick reversal at the propeller is accomplished at the control board by reversing the alternator leads, the turbines being kept in operation during the reversing process at a slightly reduced speed. The automatic governor keeps the turbine speed in proportion to that of the motor driving the propeller. An induction motor drives the propeller, and is so well insulated that it could practically be operated in the water. The installation on the *Victorious* consists of a high-speed 3,180-h.p., 8-stage turbine of the impulse type, driving a 50-cycle, three-phase alternator, which delivers power to a total of 2,250 kW to the control board. On the control board are placed the levers controlling both automatically and by hand the amount of power delivered to the 3,000-h.p. induction motor, which drives the propeller at a speed of 100 r.p.m.—*The Steamship.*

Decorative "Fullolite" Lighting.—The accompanying illustration depicts one of a number of fittings installed in a London showroom, in which 40-W "Royal Ediswan" "Fullolite" lamps are used. The lack of glare and the perfect diffusion of light, which are the chief characteristics of these lamps, ensure a soft and practically shadowless illumination over a wide area.



DECORATIVE "FULLOLITE" FITTING.

INSTITUTION NOTES.

Institute of Transport.—The principal officers of the Institute for the year 1922-23 are as follows:—*Hon. President*, Lord Ashfield of Southwell; *President*, Sir Sam Fay; *Vice-Presidents*, Sir J. G. Broadbank, Sir Lynden Macassey, Sir H. W. Thornton, Mr. H. H. Gordon, Mr. E. S. Shrapnell-Smith, and Mr. Arthur Watson. *Hon. Treasurer*, Sir Philip Nash. Mr. H. E. Blain has consented again to act as hon. secretary.

Institution of Mechanical Engineers.—The summer meeting of the Institution commences on June 12th, and will continue until June 21st. A very full programme has been arranged, including the reading of several papers, and visits to various towns in France and Belgium. The first part of the meeting takes place in Paris, and the latter part in Liége. Among the papers to be read is one on "Electric Locomotives," by Sir Vincent L. Raven, K.B.E. The visits will include the new Gennevilliers power station, the Eiffel Tower wireless station, and the works of a number of electrical manufacturing companies.

Junior Institution of Engineers.—On June 1st, Sir Eric Geddes, G.C.B., delivered the fourth quadrennial Gustave Canet Lecture; Mr. C. H. Wordingham, C.B.E. (President) occupied the chair. Sir Eric took as his subject "The Railway Act of 1921," and dealt with it principally in its economic and financial aspects. He said it had been the aim of those who framed the measure to reconstruct our railways on a modern basis, and to provide facilities which eminent engineers of every class had long desired to enable them to improve and perfect the whole system. The community as a whole would be benefited by reduced charges; passenger rates would be lowered, and a partnership was set up between the companies and the traders—a co-operation which would lead to lower freight charges. Millions would be saved annually by the grouping system instituted by the Act. Referring to electrification, the speaker said that the lessons of the past 100 years of railway work were being forgotten. Every engineer had his own ideas as to the best system to be adopted, and he believed that various individuals were endeavouring to break away from the generally-approved standards. When, however, the four big companies were working, and the one big London group stood out pre-eminently, there would be little chance of their going astray in the matter of electrical equipment. Electrification would mean great economies; he did not refer to the multiple-unit system, which, after all, was devised to create traffic, but to the use of electric locomotives for heavy traffic. These would speed up working and eliminate the need for duplicate lines. The future of the railways was not seriously menaced by road traffic, but it was to the mechanical, civil and electrical engineers that the undertakings must look if they were going to reduce their costs.

Incorporated Municipal Electrical Association.—ANNUAL CONVENTION.—On June 20th the annual convention of the I.M.E.A. will be opened at Wolverhampton. After the civic welcome, Mr. S. T. Allen will deliver his presidential address, and a paper on "The Extension of the Uses of Electricity for Domestic Purposes" will be read by Lieut.-Col. W. A. Vignoles, D.S.O. After luncheon at the invitation of the Mayor (Councillor James Thompson, J.P.) and Electricity Committee of the Corporation of Wolverhampton, the members will spend the afternoon at Apley Terrace, on the River Severn, and in the evening the Mayoress will hold a reception. On the following day the convention will sit at Stoke-on-Trent, and a paper on "The Administration and Control of Electricity Departments" will be read by Mr. E. Calvert. The Electricity Committee of the Corporation of Stoke-on-Trent will entertain the visitors at luncheon, and after visits to the power station, main sub-station, or pottery works, tea will be taken at Trentham Gardens. On Thursday, June 22nd, the members will assemble at Birmingham, and a paper on "Sub-station Equipment, including Automatic Control," will be read by Mr. R. A. Chattock at the Magnet Club of the General Electric Co.'s Witton Works, after which the works will be visited, and luncheon will be served at the Magnet Club. In the afternoon a visit will be paid to the Nechells power station of the Birmingham Corporation, and the Lord Mayor will entertain the members at the Botanical Gardens. In the evening the annual dinner will be held at Wolverhampton. On the concluding day the annual general meeting will take place, and in the afternoon Mr. S. T. Allen will welcome the members on a visit to the Corporation Electricity Works, of which a full description was published in the ELECTRICAL REVIEW of July 30th, 1920. The extensions of the Stoke-on-Trent power station (of which Mr. C. H. Yeaman is engineer and manager) were described in our issue of April 21st, 1922.

Institution of Mining Engineers.—The general meeting of the Institution will be held at Sheffield, by invitation of the President and Council of the Midland Institute of Mining, Civil, and Mechanical Engineers, on June 20th, 21st and 22nd.

Cardiff University College Engineering Society.—Sir Charles Parsons and Sir Dugald Clerk have accepted the invitation of Professor David and the engineering students to become hon. presidents of the Society. The Society has decided to issue a bulletin at intervals giving a list of the appointments secured and distinctions obtained by past students, some of whom hold important posts in the engineering world.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Major T. F. PURVES, who on June 1st became Engineer-in-Chief to the Post Office, was born at Blackadder Mount, Berwickshire, on the 31st December, 1871, entered the Post Office service by open competitive Civil Service examination in 1889, and was appointed as telegraphist at Edinburgh. He studied science at the Heriot Watt College and at Edinburgh

University, and in 1892 he won the first medal of the Heriot Watt College in electricity and technical telegraphy, as a result of which he was transferred to the engineering department of the Post Office in Edinburgh.

In 1894 he secured, by departmental examination, an appointment as mechanical and electrical draughtsman in the Engineer-in-Chief's office, London, and in 1900, after a further competitive examination, held by the Civil Service Commissioners, he was appointed "Technical Officer" on the Headquarters staff of the Engineer-in-Chief. In 1905 he became Assistant Superintending Engineer for the London district, and the following year he was transferred to a similar position in the southern district of England. In 1907 he returned to headquarters as Staff Engineer, in charge of the designs section of the engineering department, in which position he controlled the technical development and the supply of all classes of apparatus and plant used in the telegraph and telephone services. On the outbreak of war he took a keen interest in the supply of electrical equipment to the Army Signal Services, in which many thousands of the Post Office engineering staff were engaged. When bitter experience of the unprecedented conditions of modern trench warfare pointed to the urgent need for new invention, he devised and sent out special adaptations of telegraph and telephone apparatus, which were eagerly accepted by the armies in the field. As a result the Director of Signals in France invited him to make a systematic study of conditions at the front, and this led to an arrangement with the War Office by which he took up a commission in the Royal Engineers as a liaison officer between the Army Signal services on the one hand and the

Major T. F. Purves, O.B.E.,
Who has succeeded Sir William Noble as Engineer-in-Chief to the General Post Office.

producing resources of the Post Office on the other. Right up to the end of the war he continued to move backwards and forwards between England and France, travelling all over the British lines, studying and discussing the developing needs of the Signal Service, and, on his return to England, setting about devising and supplying means of meeting them. Major Purves, with his car-load of new "gadgets," became quite a well-known and welcome figure to Signal Service officers all along the British front. He designed a remarkable series of new types of electrical signalling and detecting apparatus for all kinds of military purposes, and controlled their manufacture and supply. The volume of requirements was enormous, and the value of the orders placed for these specially designed items exceeded one million pounds. In the later phases of the war the system of telegraph and telephone communications of the British Armies reached an extraordinary degree of development and efficiency, far beyond that of any other nation engaged in the struggle. Major Purves bore the responsibility for the main equipment of the Army, and his services were of incalculable value to his country.

In June, 1919, Major Purves was appointed Assistant Engineer-in-Chief in succession to Sir William Noble, whom he now succeeds, at the age of 50, in the position of Engineer-in-Chief.

In the course of his career Major Purves has come into intimate contact with all aspects of the work of the Engineering Department, and has himself, for the past twenty years or more, exercised a powerful influence upon the practice and the policy of the department. His appointment as Engineer-in-Chief is welcomed as that of one who despises red tape and has no respect for mere precedent, and as a guarantee that straightforward and honourable dealings and the pursuit of an enlightened and progressive policy will rule the future of his department.

The position of Engineer-in-Chief to the Post Office involves the supervision of almost every type of electrical engineering plant, to the value of nearly one hundred millions sterling, the responsibility for an expenditure of about fifteen millions per annum on new construction and maintenance, and the control of a highly technical staff numbering about 25,000.

Major Purves is in the happy position of being able to say that his thirty-three years of service have not been interrupted by a single day's sick leave, and that in all that time he has never made a single application for a position or a promotion or had recourse to influence of any kind in that connection—a fact which he regards as a strong testimonial to the single-mindedness and impartiality of Post Office administration, and as a guarantee to young men who are thinking of entering its service that they will be treated fairly on their merits, no matter who they are or where they come from. He believes that the prospects of smart men entering the engineering grades of the service at the present time are distinctly good.

We read in the Special Electrification Number of the *South African Railways and Harbours Magazine* that Mr. T. P. Pask, M.I.E.E., Superintendent of the Electrical and Telegraph Department of the South African Railways, was to leave Johannesburg on May 5th for England, on extended leave of absence. At a gathering on April 27th of railway electricians and other members of the service, he was presented by Mr. F. W. Mills, chief electrical engineer, on behalf of the staff of the electrical department, with a gold snuff box as a slight souvenir of their pleasant association with him and a mark of their regard.

We read in the *Electrical Contractor* that at a meeting of the Council of the Electrical Contractors' Association held at 11, Southampton Row, London, W.C. 1, on April 25th, Mr. H. Marryat was nominated as president for the ensuing year, and the nomination was adopted.

The general manager of the tramway and electricity undertaking of the Aberdare Council, Mr. A. J. Abraham, has resigned to become general manager of the Bexley Heath Electricity and Tramway Departments and the Dartford Light Railway. He has been in charge of the Aberdare undertaking since its inception in 1913.

The marriage took place at Bristol, on June 1st, of Mr. Harry Frederick Trewman, M.A., Professor of Electrical Engineering at the Artillery College, Woolwich, and Miss Violet Christine Blanche Morse, only daughter of Mr. and Mrs. R. W. Morse, of Bristol. The presents included a pair of silver vases from the electrical engineering branch of the Artillery College, Woolwich.

The marriage took place at the Parish Church, Queenborough, Kent, on May 27th, of Mr. Roger Hodgson, chief electrical engineer, R.N., of Newcastle-on-Tyne, and Miss May Crowe, youngest daughter of Mr. Crowe, of Eastchurch, Sheppey.

South Africa states that the City of Cape Town electrical engineer, Mr. George H. Swingler, who is coming to England on leave, was entertained by the senior officials of the Electricity Department at dinner on the eve of his departure, and received a handsome presentation.

Mr. H. H. Burnese, M.C., B.Sc., A.M.Inst.C.E., A.M.I.Mech.E., has been appointed lecturer in civil engineering at the University College of Swansea. At one time he acted as assistant to the construction staff of the Dundee Electricity Department, under Mr. H. Richardson, and during the war he spent three years in France with the R.G.A., attaining the rank of major, and gaining the M.C.

The Gravesend Town Council has reduced the salary of the electrical engineer, Mr. C. F. McInnes, by 9/26ths of his excess salary over the basic salary. The latter is £500, the excess salary £150, and the reduction £50.

Mr. A. T. West has resigned his position with Pope's Electric Lamp Co., Ltd., to take up the post of Southern and Eastern Counties Representative with the Z Electric Lamp and Supplies Co., Ltd. Mr. G. S. Williams having resigned his position as northern manager of Pope's Co., has been appointed to a similar position with the Z Electric Lamp and Supplies Co., Ltd., at its new branch at Liverpool. Mr. W. J. May has been appointed sales manager and secretary of Pope's Electric Lamp Co., Ltd.

The Birthday Honours List.—The inclusion in the Birthday Honours List of Mr. George Sutton, chairman and managing director of W. T. Henley's Telegraph Works Co., Ltd., is an event which gives rise to widespread satisfaction. Not only will his co-directors and shareholders, always so appreciative of

his services to the company and to the cable-making industry, be eager to offer their congratulations, but the staff and employés of the company, and a very large circle of *confrères* and admirers in the electrical industry will hold that by all kinds of meritorious service Mr. Sutton has well deserved his baronetcy. Sir George, as we shall now know him, has for many years been interested, outside his immediate electrical interests, in educational matters and in local government, and has been a generous supporter of charitable movements both in and beyond the electrical industry. A brief account of Sir George's career appeared in the ELECTRICAL REVIEW for March 17th, 1922, p. 381. Among the other new baronets there are two well-known contractors, Lieut.-Col. Sir J. Norton-Griffiths, M.P., and Mr. Edmund Nuttall, A.M.I.C.E., of Nuttall & Co., civil engineers and contractors, of Manchester. Another contractor (Mr. Edwin Airey, governing director of William Airey & Son, engineers and contractors) is among the new knights, as are also Major C. G. C. Hamilton, M.P. (Altrincham); Mr. Ernest Montague Hughman, late of the firm of Pyne, Hughman & Co., engineers, in India (the honorary secretary of the I.E.E. in India, who recently rendered considerable assistance to the Benevolent Fund of the Institution); Mr. E. M. Iliffe, of the well-known firm of Iliffe & Sons, motor and engineering publishers; Alderman Kay, who has twice served the city of Manchester as Lord Mayor, and has for many years had electricity supply interests at heart; Dr. E. J. Russell, F.R.S., director of the Rothampsted Experimental Station under the Ministry of Agriculture; and Mr. William Walker, C.B.E., who recently retired from the post of Director of Health and Safety in the Mines Department of the Board of Trade. Dr. Thomas Rauben Lyle, F.R.S., chairman of the Electricity Commissioners of the State of Victoria, becomes a knight bachelor. To all of the foregoing gentlemen the ELECTRICAL REVIEW offers its hearty congratulations.

Obituary.—MR. E. A. DORAN.—We regret to read in the *Times* "Deaths" Column that Mr. Edward Anthony Doran, C.I.E., late Postmaster-General, Posts and Telegraphs, India, passed away on May 11th at Mount Abu, India.

Wills.—The late Sir F. W. R. FRYER, chairman of the Rangoon Electric Tramways & Supply Co., Ltd., left £39,489 net personalty and £59,581 gross.

NEW COMPANIES REGISTERED.

Breward Sales Co., Ltd. (182,055).—Private company. Registered May 26th. Capital, £10,000 in £1 shares. To carry on the business of manufacturers, designers and importers of and dealers in electrical plant, house lighting sets, accumulators, batteries, dynamos, and electric fittings of all kinds, electrical equipment for motor cars, launches, and boats of all kinds, &c. The subscribers (each with one share) are: W. A. Anderson, 94, West Road, Westcliff-on-Sea, accountant; L. R. Shaw, 90, Temple Chambers, E.C., accountant. S. E. Smith signs as director. Registered office: St. Margaret's House, 57-9, Victoria Street, S.W.1.

H. Haydon & Co., Ltd. (182,123).—Private company. Registered May 29th. Capital, £1,500 in £1 shares. To carry on the business of electric light and general electrical engineers, &c. The first directors are: H. H. Haydon, "Woodhorn Villa," Bruxby Street, Syston, Leicester (managing director); R. Dunn, 90, Lorne Road, Clarendon Park, Leicester. Secretary: R. Dunn. Registered office: 3, Welford Road, Leicester.

Radiola Wireless Telephone Parts Co., Ltd. (182,102).—Private company. Registered May 27th. Capital, £8,000 in £1 shares. To carry on the business of manufacturers, importers and exporters of and dealers in wireless telephones and telephonic and telegraphic apparatus, parts and accessories, &c. The first directors are: W. Mansfield, 17, Brunswick Street, Liverpool; J. F. Little, 17, Brunswick Street, Liverpool, and 129, East 81st Street, New York, U.S.A. (both permanent, subject to each holding £500 shares). Secretary: W. Mansfield. Registered office: 17, Brunswick Street, Liverpool.

H. D. Butler & Co., Ltd. (182,157).—Private company. Registered May 30th. Capital, £2,500 in £1 shares. To acquire the business of a wireless engineer and electrical instrument maker and agent, all carried on by H. D. Butler at 222, Great Dover Street, W., as "H. D. Butler & Co." The first directors are: H. D. Butler (permanent managing director), 222, Great Dover Street, W.; G. A. Huxley, 392, High Holborn, W.C. Qualification, £200. Remuneration of H. D. Butler as managing director, £6 per week. Registered office: 15, Queen Street, Cheapside, E.C.2.

L. McMichael, Ltd. (182,184).—Private company. Registered May 31st. Capital, £10,000 in £1 shares. To carry on the business of wireless engineers and contractors, dealers in electrical, magnetic, galvanic and other apparatus for use in connection with the business of a wireless, telephone and telegraph supply company. The permanent directors are: Hubert Leslie McMichael, M.I.Radio.E., 32, Quex Road, West End Lane, N.W.6; Reni H. Klein, M.I.Radio.E., 18, Crediton Hill, West End Lane, N.W.6; Armand G. Bloch, "Brenthurst," Tenterden Grove, Hendon. Remuneration, £300 per annum, divided between them. Secretary: Leslie McMichael. Registered office: Providence Place, West End Lane, Kilburn, N.W.

Sunray, Ltd. (182,199).—Private company. Registered May 31st. Capital, £2,000 in £1 shares. To carry on the business of manufacturers of and dealers in electric cables, wires, lines, lamps and all kinds of electrical plant and accessories, &c. The first directors are: J. A. Hartley, 37, School Road, Stretford; C. S. Wallbridge, 81, Claremont Road, Alexandra Park, Manchester. So long as the Harland Engineering Co., Ltd., holds 75 per cent. of the issued capital, it may nominate three representatives on the board, to be known as the "Harland directors." Qualification (except "Harland directors"): 100 shares. Registered office: 196, Greengate, Salford, Manchester.

South-Eastern and Chatham Construction and Power Co.—Registered on May 29th, with a nominal capital of £10,000 in £10 shares. The objects are: To adopt an agreement with the South-Eastern Railway Co., the London, Chatham and Dover Railway Co., and the South-Eastern and Chatham Railway Companies Managing Committee, and to carry on the business of engineers, general contractors, contractors for the electrification of railways, tramways or similar works, constructors of generating and transforming stations, suppliers of electricity or other energy, &c. The minimum cash subscription is 7 shares. The first directors are: H. C. Orme Bonsor, J.P., 38, Belgrave Square, S.W.1; Brigadier-General Hon. Everard Baring, 26, Hyde Park Street, W.; Viscount Chilston, 36, Lower Belgrave Street, S.W.; Rt. Hon. Sir William Hart Dyke, Bt., P.C., D.L., Lullingstone Castle, Eynsford, Kent; Charles Sheath, J.P., Bexley, Kent; Sir Alfred Waldron Smithers, Kt., J.P., M.P., Knockholt, Kent; P. Crosland Tempest, C.B.E., M.I.C.E. No dividend shall be paid to the shareholders of the company in excess of a dividend at the rate of 4 per cent. upon the amount paid up on the shares held by them respectively. Subject to the payment of this dividend, if and so far as the same shall not be provided out of the sums payable as rent by the Corporations under the said agreement and the lease to be granted in pursuance thereof, any profits made by the company shall be credited to the Corporations on account and in reduction of the sums so payable by the Corporation as rent. Qualification: 1 share. The directors are not entitled to any remuneration. Solicitor: H. H. Groves, 9 and 10, Railway Approach, London Bridge, S.E. No notice of situation of registered office was filed at time of incorporation. The file number is 182,131.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

I.T.E. Electric Co. (1907), Ltd.—Satisfaction in full on May 19th, 1922, of debentures dated December 6th, 1907, securing £2,400.

S. Gillitt & Co., Ltd.—A. Dees, of 25, James Street, Newcastle-on-Tyne, ceased to act as receiver and manager on April 29th, 1922.

Watford Electric and Manufacturing Co., Ltd.—Conveyance dated May 9th, 1922 (supplemental to mortgage dated November 16th, 1920, and transfer of mortgage dated November 16th, 1921), to secure a further £5,000 charged on certain land at Watford. Holder: J. Fletcher, Carnarvon.

Watson, Marsh & Co. (Hampstead), Ltd.—Satisfaction in full on May 13th, of mortgage dated April 3rd, 1922, securing all moneys due or to become due.

James Keith & Blackman Co., Ltd.—Satisfaction in full on May 15th, 1922, of debenture dated May 15th, 1914, securing £300.

Calcutta Electric Supply Corporation, Ltd.—Particulars of £202,500 debentures authorised May 3rd, and covered by trust deed dated May 22nd, 1922; present issue £90,000, charged on the company's undertaking and property, present and future, including uncalled capital. Trustees: Metropolitan Trust Co., Ltd. (There is a discount of 6¼ per cent. on the present issue of £90,000.)

Yorkshire Incandescent Electric Lamp Co., Ltd.—Issue on March 13th, 1916, of £1,400 and on March 10th, 1922, of £200 first debentures, part of a series (filed May 25th, 1922). J. A. Couper, of Stoney Lea, Ilkley, was appointed receiver on May 24th, 1922, under powers contained in second mortgage debentures dated October 1st, 1914.

CITY NOTES.

Oriental Telephone and Electric Co., Ltd.

Sir H. Babington Smith presided over the 28th ordinary general meeting on June 1st, and in moving the adoption of the report said that the results of the year 1921 were not unsatisfactory. The net revenue for the year, £49,227, was almost identical with the corresponding figure, £49,207, for the preceding year; they were, therefore, able to recommend the same dividend and bonus as last year, and to transfer £10,000 to depreciation and general reserve, and £2,000 to the staff pension fund, as they did a year ago. Although the total revenue was the same, there had been variations in the different items. The Bombay Telephone Co. had reduced its dividend from 16 to 14 per cent., whi.e the dividend of the Bengal Telephone Co. remained unchanged at 10 per cent. The China & Japan Telephone Co., which had to pass its dividend last year owing to fluctuations in exchange, had been able this year to pay the usual 10 per cent. dividend and a bonus of 10 per cent., thus making up the dividend which was passed. The business continued to expand at their own branches. The number of exchange lines had shown the satisfactory increase of 10 per cent. during the year. The net proceeds showed a decrease, owing mainly to the fall in the Indian exchange, but the prospects of further expansion were good, and under the new arrangement with the Indian Government the maximum rates at Madras and Rangoon would be increased. Negotiations were also in progress in Mauritius for an increase in rates. Proceeding to refer to the important question of the Indian licences, the chairman said he was glad to say that the matter was at last settled. The negotiations began in India more than two years ago; they were continued in this country, and they had now been finally concluded in India. The conditions accepted by the Government of India would, they believed, enable the companies to provide a thoroughly efficient service on fairly remunerative terms, and would consequently make it possible for them to raise the capital required for the normal growth and improvement of the systems. The terms, briefly, were that the Government undertook not to exercise its option of purchasing under the existing licence before 1943. If the option was exercised then, the purchase would be on the terms defined in the original licences—on plant value without any payment for goodwill. Conditions were laid down for securing efficiency in the plant and its operation, including the obligation to provide automatic or central battery plant in all exchanges with over 300 subscribers. The maximum rate chargeable for an exchange connection within a radius of four miles of the exchange was raised from Rs.250 to Rs.350 per annum per subscriber, subject to certain conditions as to periodical revision of the rates, such revision to be on the basis of a standard dividend

of 12½ per cent. on the paid-up capital. The agreements applying those conditions to the Bombay and Bengal companies had already been signed. Those relating to the branches at Madras and Rangoon were practically settled, and would be signed in the near future. It was probable that it might be found advisable to form separate Indian companies to take over the systems at Madras and Rangoon. At the request of the board, Mr. Parker Ness, the vice-chairman, had made another journey to the East. He left this country last October, and had visited Bombay, Calcutta, Madras, Rangoon, Singapore, and Hong Kong. He was now at Hong Kong, and would pass through India again on his return journey. His presence in India had been most valuable, and had contributed in no small degree to the successful conclusion of the negotiations and to the settlement of the new basis for the Indian undertakings. They had also found it necessary to ask Mr. W. E. Cook, their consulting engineer, to undertake a journey to India, Singapore, and Hong Kong, for the purpose of advising them on numerous questions which had arisen or which might arise in those places. As they might be aware, Mr. Cook was recently appointed by the House of Commons Committee on Telephones to be its technical adviser, and there was no telephone engineer in whose advice they could have greater confidence. He was giving particular attention to the question of the use of automatic exchanges in tropical climates, and he would also advise them on questions of rates and organisation generally, as well as on the valuation of their plant—a matter of great importance when they were considering the transfer of undertakings to local companies. The speaker had mentioned last year that the new exchange at Singapore had been brought into use in June, 1920. The new plant was found to be satisfactory, and the efficiency of the service given was now generally recognised. The Singapore licence expired at present in the year 1934, and foreseeing the difficulties which must inevitably arise when a telephone undertaking approached the end of its existence, they had for some time past been in communication with the Singapore Government with a view to an extension. They were not without hope that the Government might recognise the force of their representation and agree to this. If it was desired by the Government and the local community, they would be quite ready to consider the question of transferring the undertaking to a local company. Similar questions had arisen at Hong Kong, and they had just heard from Mr. Parker Ness that an agreement had been arrived at for an extension of the Hong Kong licence to 1955; for a revision of the rates; and for the formation of a local company, the Oriental Co. to receive payment for its property in debentures and shares of the new company. It still remained to embody the terms in a formal agreement, but, provided no hitch arose, he hoped the arrangement might be finally signed before Mr. Parker Ness left Hong Kong. Having referred with satisfaction to the fact that the liquidation of the Egyptian company had at last been completed, he said he believed they were entering upon a new period of progress in the history of the company. A telephone enterprise, if it was to be efficient, and to keep pace with the demands for extension and modernisation of the plant, must be prepared to spend money freely, and must be in a position to raise capital for this purpose. The conditions now settled for the Indian licences gave security of tenure for a certain period and a reasonable increase of rates. There was a good prospect of similar arrangements in Hong Kong and Mauritius, and perhaps in Singapore also. If those prospects were realised they would have the essential conditions necessary for progress. He could give them some figures to show how rapid that progress was likely to be. The number of exchange lines now existing in the systems worked by the Oriental Telephone Co. and the Associated Companies was 35,000. The increase in the last two years was 6,850; that was at the rate of about 25 per cent. on the number at the beginning of that period. There was every reason to expect that this rate of increase would be exceeded; but, assuming that it was only maintained unchanged, the number of lines would be more than trebled in the next ten years.

Mr. H. Johnstone Grewing seconded the motion, which was adopted unanimously.

Shanghai Electric Construction Co., Ltd.

Sir Alfred Dent, K.C.M.G., presided at the annual meeting on May 31st. He said that the operating profits reckoned on the usual basis of 2s. to the dollar, were larger than ever before. Negotiations with the Shanghai municipality regarding the extension of the railless traction system and for improved track facilities were well advanced, and it was hoped shortly to commence the first instalment of the improvements. All the new routes being developed had received the approval of the Municipal Council, but agreement had not been reached as regarded terms and conditions. Negotiations had been opened with a view to administering the Singapore system of the Singapore Electric Tramways Co. Subsequently to the adoption of the report, Mr. Donald McColl, the general manager, said that the number of passengers carried had risen from 11¼ millions in 1909 to 120 millions in 1921, with only a mile and a third of additional route. This was evidence of the need for extensions.

Automatic Telephone Manufacturing Co., Ltd.

The profit for the year ended December, 1921, was £28,579, plus £6,861 brought forward, making £35,440. From this have to be deducted directors' fees, £2,560; debenture interest, £9,567; depreciation on patents, goodwill, buildings, plant, and machinery, £3,000; one-fifth development expenditure written off, £3,000; proportion of debenture issue expenses written off, £1,000; dividend on preference shares, £12,000; carrying forward £4,313. The disappointing result of the year's effort was attributable to the exceptional trading and economic conditions prevailing throughout the year. Although seriously interfered with by the coal strike and the consequent dislocation of productive effort, output was on quite a satisfactory scale, and, under normal trading conditions, would have disclosed much better results. In common with other manufacturers, the company has been faced with two main difficulties of an unprecedented character, viz., the heavy cost of financing orders, due to the high bank rate, and the steady decline in the value of all commodities, necessitating considerable writing down of stock values. The directors regret that, under the circumstances, they are unable to pay any ordinary dividend. During the year Mr. E. A. Mellinger resigned from the board and the vacancy was filled by the appointment of Sir Alexander Roger, who was also elected to the chair. Mr. James Taylor has retired from the chair, but he retains his seat on the board. Mr. J. B. Russell retires through ill-health.

Meeting: Liverpool, July 6th.

International Automatic Telephone Co., Ltd.

The profits for the year ended December, 1921, were £11,799, plus £634 brought forward, making £12,433. After deducting directors' fees, £8, and the dividend on preference shares, £11,782, £643 is to be carried forward. The profit for the year will not allow of a dividend being paid on the ordinary and deferred shares. Like most companies whose revenue is derived from industrial undertakings, the company has felt the effects of the adverse trading conditions which prevailed during the year; also the productive efforts of the allied company, Automatic Telephone Manufacturing Co., Ltd., were retarded by the long coal strike. During the year additional shares were issued, viz.: 5,345 seven per cent. cumulative preference shares of £1 each and 6,825 ordinary shares of £1 each in exchange for a like number of shares of Automatic Telephone Manufacturing Co., Ltd. These shares were issued on the terms of the original offer of February 7th, 1920. During the year Sir A. Roger joined the board, and he is taking an active part in directing the affairs of the company. Mr. T. Gary resigned the chairmanship, retaining his seat on the board, and Sir A. Roger was elected chairman.

Meeting: Liverpool, July 6th.

Anglo-Argentine Tramways Co., Ltd.

The annual general meeting was held in London on May 30th. Sir George A. Touche, Bart., who presided, in presenting the report and accounts said that he feared the report might have caused some disappointment to shareholders, although they were prepared for much less favourable results than those of the previous year. He hoped, however, to mitigate their disappointment. The reasons for the reduced revenue were the difference in the exchange which was not so helpful as in 1920; and the credit for income tax received in 1920 did not recur. With the exchange so unstable there was bound to be an enormous difference in results, but there were indications of improved conditions in Argentina, which helped to make the exchange outlook more hopeful. It was to be noted that, although the total revenue had decreased, the traffic revenue had improved; that was a true indication of the success of the undertaking. This revenue depended upon the growth of population. Since 1910 the increase had been over 400,000 in Buenos Aires. The traffic conditions led to congestion which made the operation of the company's services very difficult, and the rolling stock was being used to its utmost capacity. Last year the system carried nearly ninety million more passengers than in 1916, and the cars ran seven million more miles. The traffic expenses were £65,093 in excess of the previous year. While £57,218 of this represented increases in wages, it must be remembered that there was a substantial increase in the number of passengers. Traction expenses were £644,724. These were governed by the cost of fuel and a large saving had been expected. In 1920, the traffic expenses were £812,693, but for the purposes of comparison a special payment of £64,047 should be deducted, reducing the amount to £748,646. It was seen, therefore, that the decrease in traction expenses was just over £100,000. In this there was ground for encouragement as in previous years their main difficulty had been the cost of fuel. Now, of the many problems which beset them, they could consider fuel a minor one. Maintenance costs increased by £71,755, but with the constant demands upon their services, necessitating heavier charges for upkeep, and with more cars added to the stock, such an increase was to be expected. The cost of paving streets, charged to capital, was £24,917; this was one of the obligations imposed by their concession and could not be avoided. In 1920, when the expenditure was abnormally low, the directors had added £51,161 to the

actual outgoings, increasing the renewals reserve fund to £340,000. They might have drawn upon this reserve to meet part of the 1921 charges, but it was not considered desirable to reduce the fund below £340,000, and the whole of the year's expenditure was, therefore, charged to revenue. The large sum of £433,481 had been paid to the municipality in rates and taxes. This consisted principally of the percentages on their traffic receipts, payable in accordance with the terms of their concession. The increase in traffic and the advance in fares had only helped to balance the additional expenditure; they had not yet given the revenue necessary to yield a fair return on the company's capital. From an administration point of view there was some comfort in the knowledge that they were reducing costs, but, from an investment point of view, the position was less satisfactory, as apparently no reduction in working costs could keep pace with additional charges either imposed by authority or rendered necessary by the cost of living. They had had to sell their 5 per cent. War Stock in the early part of the year to meet the heavy claims of the Government for income tax. The speaker did not know if it was fully realised in Buenos Aires that the income tax was deducted from the dividends of individual proprietors, and was, therefore, not borne by those who travelled by the company's cars. The question had arisen whether they should pay a full year's dividend or only a half-year's dividend on the second preference shares. To pay the full year it was necessary to encroach upon the amount carried forward, reducing it to £6,031. Although the directors hesitated to do this they felt that it was desirable to prevent arrears on the second preference shares increasing. There was still four years' arrears of dividend on these shares, while the ordinary share capital of £3,250,000 had received no return since 1914. The city was supplied with the finest tramway service in the world, and the business should be self-supporting on a commercial basis. Unless a change was made people would be reluctant to embark on further tramway development, and it would receive a check; a prosperous company always rendered the best service. The present tariff arrangement was made in 1920, and was subject to review in 1923. It would soon be necessary to review the position, and they were confident that the question would be approached by the authorities in a fair and judicial spirit. With regard to the future, he could give no forecast of the date at which the arrears of dividend upon the second preference shares would be paid off, enabling them to distribute a dividend on the ordinary shares. The future was governed by too many unknown quantities. Happily, there were signs of real improvement, but these should not be exaggerated. The report was adopted.

British Electric Traction Co., Ltd.

The gross profit for the year ended March 31st, 1922, amounts to £262,895, compared with £264,772 for 1920-1921. After deducting the general expenses, viz., £44,402, there remains a net profit of £218,494,. plus £177,319 brought forward. After charging debenture stock interest, amounting to £84,451, and placing to reserve £14,677, there remains a balance of £296,684. After paying a dividend of 6 per cent. for the year upon the cumulative participating preference stock, which requires £42,765, a dividend of 4¼ per cent. for the year is recommended upon the ordinary stock, requiring £59,682, leaving to be carried forward to next account (subject to Corporation Profits Tax for the years ended March 31st, 1920, 1921 and 1922) £194,238. The net profit of £218,493 for the year compares with £220,197 for the preceding year. The amount standing to the credit of reserve account at March 31st, 1921, was £500,000. The reserve now amounts to £520,000. The investments, which now stand in the balance sheet at £3,987,618, show an increase of £125,802, compared with the preceding year. These investments yielded a revenue of £208,998, representing an average of 5.24 per cent. for the past year as compared with 5.39 per cent. for the preceding year.

Meeting: June 16th.

Swedish Ericsson Company.

The report of the Allmänna Telephon A. B. L. M. Ericsson, which absorbed the Cedergren Industry Co., also contains the figures for the latter company in 1921, and states that the value of the deliveries amounted to 19,260,000 kronen, of which the exports represented 91.1 per cent. In 1920 the Ericsson Co. alone had a turnover of 14,840,000 kr. as compared with 15,780,000 kr. in 1919, the exports forming 72 per cent., and 68.7 per cent. of these totals in the two years respectively. The value of the orders received in 1921 was 9,970,000 kr., and the orders on the books at the end of the year represented 8,670,000 kr., as against 17,000,000 kr. at the close of 1920. After writing off 720,000 kr. for depreciation the accounts show net profits of 2,716,000 kr., and it is proposed to pay a dividend at the rate of 3 per cent. on the share capital, which now stands at 80,678,000 kr., as compared with 73,800,000 kr. in 1920. The Ericsson Co. itself paid no dividend for 1920, when the necessity for making heavy provision for depreciation owing to the fall in prices led to a large loss. Concerning the company's subsidiaries, the report states that the workshops of the Russian company in Petrograd continued undamaged, and were under the management of a Government representative. It had still been impossible to enter into any negotiations in regard to obtaining payment for the telephone system at Moscow, which was handed over to the Russian State in 1917, and which belonged to the Swedish-Danish-Russian Telephone Co. The report also refers to the situation of the subsidiaries in England, Austria, Hungary, Holland, France, Finland, and Mexico, and mentions that the sales organisation in Argentina has been converted into an Argentine company.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a:

Llanelly and District Electric Lighting and Traction—135,000 ordinary shares of £1 each, fully paid, Nos. 1 to 60,000, 135,001 to 150,000, 225,001 to 285,000; 30,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 195,001 to 225,000; and £51,681 five per cent. first mortgage debenture stock.

Mexico Tramways Co.—£211,500 six per cent. 50-year mortgage bonds, Nos. 12,501 to 14,615 (£100).

Wellington (City of).—Scrip fully and partly paid for £519,000 Electric Power Station Construction & Tramway Improvements 5½ per cent. debentures, 1920.

Hendon Electric Supply Co.—20,000 six per cent. Cumulative preference shares of £5 each, fully paid, Nos. 1 to 20,000.

Madras Electric Supply Corporation.—£200,000 seven per cent. second debentures (registered), issued at 95 per cent., partly paid and fully paid, Nos. 1 to 2,000 (£100).

North Metropolitan Electric Power Supply Co.—5,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 300,001 to 305,000; and £12,800 five per cent. mortgages of £100 each, Nos. 1,901 to 2,028.

Application has been made to the Committee to allow the following to be officially quoted:—

Argentine Tramways and Power.—250,000 ordinary shares of £1 each fully paid, 200,000 7 per cent. preference shares of £1 each, fully paid, and £200,000 5 per cent. debenture stock.

Fairbairn Lawson Combe Barbour.—100,000 ordinary shares of £1 each, fully paid, Nos. 800,001 to 900,000.

Aluminium Corporation, Ltd.—The accounts have been issued for the two years ending December 31st, 1921. The balance at the credit of profit and loss account, after deducting debenture interest to December 31st, 1921, and preference dividends for 1919 and 1920, was £25,150, out of which a dividend is recommended for 1921 of 7 per cent., less income tax upon the preference stock and shares, which will absorb £11,888, and the balance of £13,261 is to be carried forward. The Cowlyd Dam was completed during the course of the year, and with a view to the installation of a further pipeline and the carrying out of other development work, a special meeting was called for Wednesday last to authorise increasing the directors' borrowing powers by £500,000.

Compania Argentina de Electricidad.—The directors' report for the year ended December 31st, 1921, states that appreciable increases were registered both in the number of consumers and the sale of energy. The gross profit for the year, after providing $105,308 m/n for the debit balance of the interest account, was $175,656, as against $127,775 in the previous year. Of this amount $28,014 was applied to amortisation of capital invested, $97,757 transferred to reserve for renewals, the legal reserve fund received $2,594, and directors' fees absorbed a similar amount. The payment of a dividend of 8 per cent. took $45,455, and the balance ($1,242) was carried forward.

Brisbane Electric Tramways Investment Co., Ltd.—The accounts for 1921 show dividends for the year on shares held by company £99,933, plus sundry receipts £4,381, and £42,837 brought in, making £147,151. Deducting general charges in London (including corporation profits tax) and expenditure in Brisbane, the net balance was £132,487. After paying debenture interest and preference dividend, the directors recommend a balance dividend of 4s. per share, free of tax, making 8 per cent. for year, carrying forward, subject to corporation tax, £46,162.—*Financial Times.*

Lewes & District Electric Supply Co., Ltd.—The report for 1921 states that the surplus on working showed a balance of £4,575. After meeting general expenses and debenture interest and setting apart £1,750 for renewals, there remained £455, making, with £1,119 brought in,, £1,574 which is to be carried forward.

Pernambuco Tramways & Power Co.—According to the *Financier*, after providing for debenture and other interest, and transferring £10,230 to capital reserve, and £1,500 to amortisation fund, the accounts for 1921 show a credit balance of £1,108, which is to be carried forward.

Brazilian Traction Light & Power Co.—A quarterly dividend of 1¼ per cent. on the cumulative preference shares is announced.

Canadian General Electric Co.—Quarterly dividend of 2 per cent. for three months ending June 30th, 1922. on common stock.

The Dutch Ericsson Company.—The report of the Netherlands Ericsson Telephone Works Co. states that, after providing for depreciation, the net profits earned in 1921 amounted to 30,790 florins, as contrasted with 34,074 fl. in the preceding year, when a dividend at the rate of 5 per cent. was paid. The profits in 1921 have been carried forward.

Western Telegraph Co., Ltd.—The third quarterly interim dividend is 5s. per share, free of income tax, for the year ending June 30th, 1922, being at the rate of 10 per cent. per annum.

Yorkshire (West Riding) Tramways Co., Ltd.—Dividend of 3 per cent. on preference shares for half-year ending June 30th, 1922, less tax.

United River Plate Telephone Co., Ltd.—Final dividend of 5 per cent. on the ordinary shares, making 8 per cent. for 1921, free of tax, carrying forward £38,704.

STOCKS AND SHARES.

TUESDAY EVENING.

MARKETS have fallen back into a condition of languid and summer-like inanition. There is nothing much doing, either in the investment or the speculative parts of the House. Even Home Railways, which have been so very animated of late, have quieted down to a great extent; which means, of course, that prices after their rapid rise, are giving way a little from the best. In the circumstances, that they should not have gone back further is somewhat surprising. It seems as though most of the money which was seeking investment in Stock Exchange channels, instead of lying on deposit at 2 per cent. with the banks, is now fully absorbed into the markets. At all events, Stock Exchange men are talking as though they do not expect anything in the shape of good business until there is a further fall in the Bank Rate, of which, for the time being, no particular chance offers.

Districts at 38½ are ½ higher, but Underground income bonds shed a point at 82½. Metropolitans, after being 48, returned to 47. Lively demand sprang up for London and Suburban Traction preferences, the price going to 10s. 3d. before it went back to 9s. 9d. London United Tramway preference hardened in sympathy, and touched 4s. before losing a few coppers.

Brazil Tractions remain at 53, and the foreign tramways group, as a whole, is quiet, the tendency of Mexicans being towards rather lower figures. The newspapers are talking about some new insurrection in the country, and, although nothing definite is known on the point, this is quite sufficient to cause a little selling of Mexican stocks and shares. Nobody has any real information, but the rumour serves to keep possible buyers away from Mexicans for the time being. No benefit occurred to prices on the announcement that two more of the three outstanding coupons on Mexican Light and Power firsts, Mexican Electric & Pachuca fives are to be paid at the end of this month. Stock Exchange dealers, coupon-bookers, and others, are ready to buy these coupons at better prices than can be obtained by presenting them at London banks.

Canadian General Electrics at 94½ and the preferred at 111½ are both 3 points down. Calcutta Electric 7 per cent. second debentures at 2½ premium are ½ lower, and the Indian Electric debenture at 1½ premium is similarly easier. The allotments of the Madras Electric debenture stock will be out in the course of the next day or two, and there will probably be a small premium on the scrip. The dulness of the Consol market is, however, a reason for a more modest estimate being formed of prices than was apparent even a month ago.

This consideration is scarcely a factor in the list for home electricity shares. London Electrics rose to 2 1/16. Charing Cross ordinary, St. James's, and the others which improved last week, are holding all their rises, and there is a steady demand for anything which comes to market. A new introduction this week to the list is the 6 per cent. preference of the Hendon Electricity Supply Co. These shares were sold in considerable numbers on the basis of 4½, and it was not long before the price hardened to within an eighth of the par value of £5. Having regard to the way in which other good-class electrical shares have advanced lately, there is little doubt as to the Hendon preferences going over par, as investors become more familiar with the security, for the Hendon is one of the best of the London local companies. British Electric Tractions are several points better at 56½, on the increase in the dividend to 4½ per cent., against a previous 4 per cent.

The weakness in cable stocks and shares is rapidly passing away, and substantial recoveries have occurred in Eastern ordinary, Globes, Westerns and Eastern Extension shares. Being always a narrow market, the tendency is for unexpected selling, however small in amount, to exercise a noticeable effect upon prices. The stock recently on offer, however, is being readily taken. It is undoubtedly the case that some of the holders of these securities are a little nervous, as we pointed out previously, owing to the wide publicity given to the latest developments in radio-telephony and in wireless. It is held, reasonably enough, that the scope for expansion in wireless is still very wide; this will cause the shares of the Marconi Co. and its subsidiaries to remain active media for speculative investment for years to come.

At the moment Marconis are weak at 2½, owing to the pressure to realise profits. The holder of the shares, however, who is content to look upon them as an investment for the future, will disregard temporary fluctuations, and leave his certificates undisturbed, unless he is of sufficiently speculative mind to induce him to sell on any sharp rise in the hope of buying the shares back more cheaply, when any reaction occurs. Marconi Marines have eased off, at 32s. 9d., with the shares of the parent concern. In Canadians and Radios there is not much doing; the prices are dull at 11s. 9d. and 23s. 3d. respectively. Automatic Telephones are a trifle easier at 13s. 9d., on the report showing no dividend on the ordinary shares.

Metropolitan-Vickers ordinary rose to 1 3/16. Babcock and Wilcox remain at 3½. Generally speaking, the iron and steel group is better, in consequence of the expected early termination of the engineering lock-out. Electric Constructions hardened to 25s. 9d., British Insulated to 22s. 6d., and Henley's preference to 4½. On the other hand, there were small declines in Telegraph Constructions, India Rubber shares and Henley's ordinary. The Armament group improved a trifle along with iron and steel shares. Rubber issues remain in a sleepy state. What interest remains in them is fastened upon the prospect of Dutch producers falling into line with British companies in the matter of an all-round restriction of production.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price June 6, 1922.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	7½	—	£8 0 0
Charing Cross Ordinary	8	9	6¾	—	6 11 0
do. do. do. 4½ Pref.	4½	4½	3¾	—	5 16 2
Chelsea	6	6	5¾	—	5 6 8
City of London	14	14	38/9	—	7 4 0
do. do. 6 per cent. Pref.	6	6	22/6	—	5 6 8
County of London	8	8	1¼	—	6 8 0
do. do. 6 per cent. Pref.	6	6	1	—	6 0 0
Kensington Ordinary	9	10	7½	—	7 0 7
London Electric	2½	4	2 1/16	+ 1/16	5 17 8
do. do. 6 per cent. Pref.	6	6	4¼	—	6 3 1
Metropolitan	7	7	5¼	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3⅞	—	6 0 0
St. James' and Pall Mall	12	12	88	—	7 3 4
South London	7	7	3½	—	8 0 0
South Metropolitan Pref.	7	7	1 3/16	—	5 18 0
Westminster Ordinary	10	10	7⅜	—	6 15 7
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref	6	6	10¼	+ ¼	5 15 5
do. Def.	1½	34/6	23⅞	—	7 7 0
Chile Telephone	6	6	6 1/16	+ 1/16	4 15 1
Cuba Sub. Ord.	7	7	8½	—	8 4 8
Eastern Extension	10	10	18½	+ ½	5 8 1
Eastern Tel. Ord.	10	10	186½	+6	5 7 3
Globe Tel. and T. Ord.	10	10	18¾	+ ⅛	5 6 0
do. do. Pref.	6	6	11¼	+ ¼	5 6 8
Great Northern Tel.	22	24	30	—	8 0 0
Indo-European	10	10	40½	—	6 3 5
Marconi	25	15	2⅜	— ⅛	5 14 3
Oriental Telephone Ord.	12	12	2½	+ ⅛	*4 16 0
United R. Plate Tel.	8	8	7 1/16	+ 1/16	*5 7 7
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18⅜	+ ⅛	*5 6 0
HOME RAILS.					
Central London Ord. Assented	4	4	68	—	5 17 8
Metropolitan	1½	2½	47	—	4 15 9
do District	Nil	1	38½	+ ½	2 8 10
Underground Electric Ordinary	Nil	Nil	2½	—	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	2	4	82½	—1	*4 17 0
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	83	—	7 11 8
do. do. 2nd Pref.	Nil	5½	82	—	7 6 8
do. do. 5 per cent. Deb.	5	5	82	—	6 2 0
Brazil Tractions	Nil	Nil	53	—	Nil
British Columbia Elec. Ry. Pcc.	5	5	81½	—1	6 2 8
do. do. Preferred	5	99/-	70⅜	—	*6 11 6
do. do. Deferred	3	124/-	73⅜	+1	*8 10 6
do. do. Deb.	4½	4½	79	+2	5 7 7
Mexico Trams. 5 per cent. Bonds	Nil	Nil	71½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	87½	—	Nil
Mexican Light Common	Nil	Nil	19½	—1	Nil
do. Pref.	Nil	Nil	53	—	Nil
do. 1st Bonds	Nil	5	74½	—	6 14 3
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	16	3½	—	5 2 3
British Aluminium Ord.	10	10	⅞	—	—
British Insulated Ord.	15	15	22½	+ 1/16	7 1 2
Callenders	15	15	2 1/16	—	6 17 0
„ 6½ Pref.	6½	6½	1 1/16	—	5 9 5
Crompton Ord.	10	10	20/-	—	10 0 0
Edison-Swan	10	—	8/-	—	—
do. do. 5 per cent. Deb.	5	5	66	—	7 13 10
Electric Construction	10	10	1 3/16	+ 3/16	7 16 0
English Electric	8	8	15/-	—	6 13 4
do. do. Pref.	6	6	18/3	—	6 11 6
Gen. Elec. Pref.	6½	6½	22/3	—	5 16 10
do. Ord.	10	10	21/3	—	9 8 2
Henley	15	15	2⅝	— 1/16	6 13 4
do. 4½ Pref.	4½	4½	4 1/16	—	5 4 4
India-Rubber	10	—	1½	— 1/16	—
Met.-Vickers Pref.	8	8	2½	—	6 8 0
Siemens Ord.	10	10	27/-	—	*7 8 2
Telegraph Con.	20	20	26½	— ½	*4 11 6

* Dividends paid free of Income Tax.

ELECTRICAL SUPPLIES IN SOUTH AMERICA.

By PERCY F. MARTIN, F.R.G.S.

The determination expressed by many of the South American States to exploit their long-dormant hydro-electric potentialities, argues the creation of an extended market for electrical machinery and accessories. Hitherto British firms have made little effort to bid in this direction, although a fair number of electrical installations, in the form of sugar-machinery, coal-cutting and dressing apparatus, loading and unloading plant, and, more recently, railway rolling-stock, may be found in certain of the States, such as Argentina, Brazil, Chile, and Peru. In view, however, of the widening of the electrical supplies market (probable throughout the whole of the ten States of South America, in practically all of which hydro-electric installations have now been decided upon), British manufacturers would do well to give attention to the demands of probable buyers.

Dealers in electrical machinery and accessories do not, as a rule, carry large stocks, owing to the expense attached to the housing of big machinery and the loss upon capital outlay. On the other hand, several foreign manufacturers, particularly those of the United States and Germany, maintain agencies with extensive show-rooms, and, judging from the many years that these have existed, it may be assumed that, on the whole, they pay for their maintenance.

Before the war, it was a common complaint among South American importers of electrical machinery and accessories that British motors and switchgear lacked sufficient attention to small details in the manufacture of terminals, bearings, lubricating apparatus or brush gear. Customers complained that motors were designed by people who "could not have had much experience of the actual operation of such plant under heavy load conditions." However much or however little truth was contained in these contentions, the fact remains that these defects in British machinery design were generally credited, and consequently, the markets for British manufactures were adversely affected.

In other connections fault was found with switchgear because, so it was declared, makers "often rated their switches too high or designed them merely to take the ordinary full load of the motor." Under normal conditions switches and circuit-breakers are not called upon to carry more than this normal current, but on overloads or short-circuits they have to carry very much heavier currents and are frequently destroyed in so doing. Yet another point raised was that, in switchgear for small currents, mechanical strength was neglected, and the current-carrying capacity appeared to be the only consideration. It seems clear that whatever current a switch has to carry, it must be sufficiently strong mechanically to withstand the roughest handling of unskilled men, such as are not infrequently placed in charge of South American plants and machinery. Although capable of being trained, South American *péons* are apt to be violent and careless unless continually watched and controlled.

In Argentina the demand for electric motors and other electrical appliances is broadening, although at one time the powerful German company, Compañia Alemána Transatlántica de Electrícidad, which supplied the city with electric light, held the greater part of the trade in accessories and small plant. Roughly, one-half of the total imports of electrical appliances came from Germany, and only one-quarter from the United Kingdom. Things are different nowadays, however, for while the Germans are still supplying the Argentine market and are finding considerable success from the abnormally low exchange, experience of German machinery has not been altogether happy; Argentine importers, who are both willing to pay and capable of paying a higher price for a superior article, would be found ready to do a much more extensive business with British manufacturers of electrical goods.

In order to compete with German manufacturers, however, it would be necessary for British exporters to do just as the Germans do—maintain in the Argentine either competent agents or branches holding large and varied stocks. Among other articles which are in demand are insulators, wires and cables, lamp-carbons, dynamos and motors, and accessories. The most severe competition in small motors, insulators, and accessories comes from the United States; but the quality-reputation of British wires and cables, dynamos and motors, and accessories and meters stands very high, the excellence of such manufactures being generally recognised throughout South America.

In the city of Rosario, the most important commercial centre next to Buenos Aires, the capital, electric motors are used to a considerable extent, those for industrial purposes being chiefly in connection with small plant and workshops. The most important electrical supply company is the Sociédad de Electrícidad de Rosario (the Rosario Electric Light and Power Co.), a British concern which, besides holding the contract for lighting the city, maintains show-rooms where many different kinds of electrical supplies, plant and machinery may be inspected and purchased. At present there are over 1,300 electric motors in use in Rosario, ranging up to 45 h.p., the greater demand being in relation to small motors of from 5 to 7 h.p. The conditions with respect to voltage, current, prices, &c., may be cited as follows:—

Main part of the city, continuous current, 440 volts for motors over 5 h.p., and 220 volts for smaller motors.

Outer districts (which are continually extending), three-phase alternating current, 200 volts for motors over 5 h.p., and 110 volts for smaller motors.

Rates for motors are as follows:—

9.7 centavos per kWh for first 30 kWh consumed per month for each horse-power installed.

5.8 centavos per kWh for remainder up to 1,000, and 4.3 centavos per kWh for consumption in excess of 1,000 kWh per month.

The Rosario company has hitherto granted special rates to large consumers, and its campaign of advertising to increase the use of electric motors has materially added to its business. It has not been customary, so far, either to own or to rent motors, except those used in its own plant.

While, as has been said, electric motors are used to a considerable extent, it has not been easy to introduce new lines, as the field is already well worked. Four of the leading manufacturers of electrical appliances, including motors, of which two are of United States and two of German origin, maintain agencies in Buenos Aires, and apparently possess a firm hold on the market. British manufacturers are, therefore, certain to meet with a good deal of competition; but novelties which have found favour on this side may also be expected to succeed in South America. It must always be remembered that where two articles are in competition, that which is backed by reputation, combined with personal effort interested in its success, has every advantage over the article which has to depend upon mere catalogue description.

In Brazil, British manufacturers, as a result of the Centennial Exhibition, may have a chance of meeting competition from the United States upon more equal ground. Hitherto, most of the imports of electrical goods into Brazil have come from America, a fact which may be attributed in a large measure to the ownership of the Rio de Janeiro, Sao Paulo, Santos, and Bahía power companies being Canadian. Their strongest industrial lines are transformers, insulated wire, generators, and motors; while the United Kingdom has led in cables, and Germany in arc-lamp carbons and incandescent lamps. There is reason to believe that active competition by British manufacturers of wiring devices,

which have lately made considerable progress both in design and manufacture, would be rewarded with no small amount of success. It should be carried in mind that the Brazilians, as a race, are very intelligent, and follow with considerable and even minute attention all patented improvements effected in foreign mechanical inventions. The Brazilians' system of higher education has devoted much more attention to technical instruction than have those of some of their neighbours. The School of Mines at Ouro Preto, in the State of Minas Geräes, may be cited as an example, this institution being, perhaps, one of the best-equipped in South America, especially with laboratory apparatus. Several high-class schools of engineering and polytechnic institutes are likewise to be found in other parts of the country where the questions of hydro-electric development are being closely studied.

Practically all Brazilian better-class stores stock lighting, heating, and cooking apparatus electrically operated. Much advance has also been made in some of the large cities, such as Rio de Janeiro, Sao Paulo, Santos, Pernambuco, &c., in window lighting by electricity, while sign-lighting, adopting very elaborate electric signs, is becoming equally common in all of these towns. British types of incandescent lamps, such as the Mazda drawn wire and the Ediswan, are much preferred to those of American or German make. Although at one time American lamps were sold in large quantities, they have not been found of the same quality as those emanating from the United Kingdom. Two popular voltages for which lamps may be designed are 125 for the city of Rio de Janeiro, and 220 for nearly all the rest of the cities. Smaller sizes are in demand, but for advertising and street-lighting lamps of 1,000 watts are not at all uncommon. The Edison screw-base is the only one in popular use, the bayonet-socket being confined to the special low-voltage lamps for train-lighting. Carbon filament lamps are sold, but in comparatively insignificant quantities. The same conditions apply to miniature bulbs or the various shapes differing from the standard pear to the round bulb.

Chile is another of the South American States where hydro-electric development may be looked for. In addition to the Government having decided upon the electrification of over 2,000 miles of national railways and the expenditure of £1,750,000 upon hydro-electric works, many private installations relying upon waterfalls have been sanctioned in different parts of the Republic. Up to the time of the war, nearly all the electric light companies in and around Valparaiso were of German origin, and naturally favoured German supplies wherever possible. Things have since changed, however, and a good deal of Chilean capital has replaced that of German origin. Business in machinery is gradually extending, while electrically-operated tramways have almost completely replaced mule-traction. The Chilean market is decidedly worth studying, especially at the present time when British manufactures of all descriptions are largely in request. Among other contracts that have recently been decided upon has been an extensive order for electric power plant for the use of the Antofagasta and Bolivia Railway Co., a British-owned line, which contemplates gradually electrifying the whole of its tracks. As this work proceeds, the demand will spring up for electrical appliances and machinery in connection with neighbouring industrial establishments and many private residences.

THE ELECTRICAL SITUATION IN INDIA.

[From a Special Correspondent.]

DURING the war Japan built up a big business connection in India in a multitude of trade lines—cotton, matches, glassware, cement, paper, porcelain and crockery, enamelled ware and numerous others, electrical accessories, insulated wire, glow lamps, bare copper wire, and porcelain insulators were almost wholly supplied from Japan, and were of course eagerly sought after, and big prices paid, as the Home and Continental markets were practically closed down. Now this is all changing; the market is shifting back again towards the West, but unfortunately not entirely to England. Goods are pouring in from Holland and Belgium, and the input from Germany is largely increasing in spite of the many earnest protestations one often heard during the heat of the struggle against ever dealing with Germany again. Italy, too, is sending her share, especially of fans, both a.c. and d.c.—one enterprising Italian firm practically dominates the market in a.c. fans at the moment.

The matter with English-made electrical goods is, of course, the old question of price. Take British-made glow lamps, for instance, both one-watt and half-watt or gasfilled. The Continental lamp is at least 20 per cent. cheaper, and when one goes closely into the life and candlepower, there isn't much to find fault with. One hears it frequently said, indeed, that the British-made lamp is not anything like as good as it formerly was, though how much actual fact there is in this sweeping statement remains to be proved. There is no evidence of German-made lamps on the market yet, but surely they will come, and probably soon. Of the German cheap shade there are vast quantities, and it is no uncommon thing to see fairly well finished lamps and lamp shades at six shillings a dozen on sale in bazaar stores! Firms are being inundated with German catalogues and trade circulars and weekly electrical trade pamphlets of the propaganda order, with subtle suggestions that "as war is now over let us revive our old friendly trade connections!" The native dealer does not, of course, bother his head about who he deals with so long as prices are tempting, and is consequently taking full advantage of opportunities; but it is open to question whether the British local firms and middlemen should encourage trade with Germany under present conditions. The argument is fairly understandable on both sides. One man says, "Why should I sit idle watching my 1920 peak-price stock of British goods growing stale on my shelves while my neighbour over the way plunges on German stuff and makes money? I can't keep the pot boiling on patriotism alone, without turnover." Another man who perhaps fought or lost a son in the war argues, "Why should I help the German to pay his war indemnity while the poor British working man, who fought that I may live, is keeping body and soul only just together on half or quarter time at home?" The real truth is probably, as Harold Cox has it, "trade has no feelings. Men will give their lives for their country, but in business they will rarely forgo the chance of a profitable bargain, even with a private enemy or a hated foreigner." The moral, therefore, for the British manufacturer and workman is obvious.

A very large number of manufacturers' representatives have been invading India this last cold weather, British, Continental, and American; and knowing the present state of business in India, one fears that their reports and orders to their head offices have not been encouraging. Some of them are experienced men who have been many times over the ground before; many of them are inexperienced youths whom you can spot by the cut of their topees and the military tag on their business cards. The older hand spies out the land carefully before he pays a business call; he finds out who is the right man to see in an office or works, when is the most convenient time to call, and, above all, he

finds out which day of the week is mail day. It may here be remarked that it is an amiable little weakness of Indian business men to make believe that the outgoing mail is the most important thing imaginable, and that he is terrifically busy on mail day—he makes a fetish of it; except under the most pressing circumstances he cannot by any possible chance see a traveller—he may as a compliment see a man with an order to place—but a traveller, never. The truth is mostly that he has put off to the last moment what he should have been doing days before, and is so worried on mail morning with business letters, and private letters as well, that he imagines he is extremely busy. At any rate, the old experienced drummer accepts the little weakness, panders to it, and never calls on a mail day. Not so the raw youth out for the first time; he looks up his list and blunders into an office disregarding the "mail day" notices in big letters scattered here and there in prominent positions, sends in his card, gets his merited rebuff, and goes away disheartened and leaves a bad impression behind.

A word of warning might here be given to the home traveller who uses too many superlatives in describing his wares, and who depreciates his rival's manufactures—even to the bad taste of mentioning names. This at once brands him as inexperienced, and results in a bad start with his would-be customer. Let him emphasise the selling points of his goods by all means, but at the same time give his competitor a chance.

One more point, worth mentioning perhaps, is the very short-sighted policy which a few travellers cannot resist, namely, of making snap retail sales instead of confining themselves wholly to wholesale or agency buyers. There have been instances recently of manufacturers' representatives taking small orders for motors, switches, and electric fans from people not in the trade. This may be considered smart for the time being, but it is remembered by resident firms to the future disadvantage of the salesman and his principals.

ELECTRIC LIGHT FOR THE SMALL TOWN.

By J. M. C. FIELD.

The small town seems just as far from obtaining a public electricity supply as ever. Take, for instance, a small country town of, say, 100 potential consumers. To lay down a central station of the ordinary type is hardly a promising commercial enterprise on such a small scale as this, and the capital required is very large; indeed, it can seldom be raised locally. The demand for power in such places is generally small, and for the present can be disregarded. What is wanted is a good and reasonably cheap supply of electricity for shop lighting, the local kinema, private dwellings, and street lanterns. Is there anything wrong in such cases with a supply given during lighting hours only, say from dusk to 11 p.m.?

The writer of this article having lived aboard ship for months on end, where only a supply of this description was available, found hardly any inconvenience from the restricted hours of service. It was far superior to gas or oil lighting, to say the least of it. A warning signal five minutes before the engine was shut down was made by breaking the circuit momentarily two or three times. A great advantage gained in this way is that limiters can be used in place of meters. Limiters not only show a saving in capital cost, but also reduce the clerical work, and, in addition, the exact revenue is known before the end of the quarter. When once the bulk of house wiring and mains work were completed, one capable man and a boy could run the whole installation.

With all-the-year-round charges of, say, 2s. 6d. per week per 250 W maximum consumption, with larger limiter settings in proportion, the revenue from 100 consumers would be about £15-£18 per week. Fuel and labour would cost about £8 per week, and a fair margin would be left for depreciation, profits, &c. If profits were made on wiring work, the total revenue would be further increased. A Special Order for such an undertaking could hardly be obtained, but if a few prominent local people were interested, permission from local authorities should be forthcoming. At any rate there would be little fear of competition.

If we assume that electricity supply in bulk will be available one day throughout the kingdom, we could regard this method of supply as temporary only. The mains and customers' installations could be laid out with that end in view, and the actual generating plant would only account for a comparatively small part of the total cost. Two direct-coupled semi-Diesel sets would probably be found most suitable for the purpose, and, together with a simple switchboard, they would occupy very little space. The storage battery has hitherto been regarded as a necessary evil of the small station, but by cutting out the 24-hour service it can be avoided and capital saved on the battery itself, the building space it occupies, the necessary boosters, &c. At the same time battery depreciation (a very heavy item in small station work) entirely disappears, and it is more than likely that the labour costs of a small non-battery station would be far less than those of a battery-equipped plant, in spite of the fact that the engine would be required to run for longer hours.

The Daylight Saving Act cuts out yearly 150 hours of engine running, and the limiter system being used the revenue would remain the same. With a few exceptions, such as hospitals, &c., no inconvenience would be caused by shutting off the supply at 11 p.m., and if by so doing it is made possible to give a supply in towns where a twenty-four hour service is practically impossible, why not do it? Surely a supply that will serve nine-tenths of the requirements is better than no supply at all.

If a bulk supply did eventually become available, the local company having mains, &c., already installed would stand a chance of selling out at a good price, or, better still, substituting transformer gear for the generating plant and running the business at a profit as local distributors. The station buildings, mains, &c., would still retain their full market value, and by the way things are going at present it is highly probable that the engines would have completed their full natural life long before a bulk supply was available for the average country town.

This idea might also be carried out in fair-sized villages, too large for the co-operative scheme previously described in this journal. In some cases it might be possible to make use of the plant during the day by arranging to give a power supply to a local factory, but the staff would have to be doubled and the wear and tear would also be proportionately increased. A public power supply would hardly be profitable for so small an undertaking.

Electrification of Industrial Plant Railways.—In a paper recently read before the Engineers' Club of Philadelphia (U.S.A.), Mr. D. M. Petty discussed the feasibility of electrifying the railways used in large industrial works, and the best method to be employed in electrification. He came to the conclusion that electrification was advisable, on the grounds of economy in working, especially where numerous starts and stops were necessitated; less depreciation; smaller repair costs; more easily executed repairs, &c. The speaker considered that storage battery locomotives should only be used in special cases, for, although this type had numerous advantages, the initial cost and the cost of replacement of batteries was very heavy. He suggested a general system of under-running third-rail collection at a pressure of 250 V. For long distance running, however, a higher voltage was recommended.

Reported New Russo-German Combine.—An Exchange Telegraph dispatch from Paris reports that a Russo-German company has just been formed, with headquarters in Moscow, and a capital of 30,000,000,000 paper marks. On the German side the company will include among its shareholders Herr Stinnes, Herr Krupp, and the Allgemeine Elektricitats Gesellschaft, and on the Russian side the Soviet Government. This combine has for its object certain large industrial works on Russian territory.

BELGIUM'S RAPID RECOVERY.

EXPORT ACTIVITIES.

Mr. R. F. H. Duke, H.M. Commercial Secretary at Brussels, has written a highly interesting report on the economic situation in Belgium* at the end of 1921. Apparently there has been some delay in its publication. It has been revised, however, to March last. As the report is the first on Belgium which has been issued since the Great War began, Mr. Duke draws some striking comparisons between conditions then and now.

He recalls the advantages she possessed in her thrifty and hard-working population, her industrial resources, her wonderful system of internal transport, and her substantial interests in foreign enterprises. At the same time, German finance was powerful in the Belgian metallurgical industry, notably in engineering and electrical enterprises, many of these being almost entirely dependent on German control for the provision of their plant and raw material. The end of the war not only found Belgium deprived of the assistance of German capital, but also found her pre-war markets closed altogether or grown dependent on other sources of supply, her industrial population decimated by war or rendered inefficient by enforced idleness and physical deterioration, and the majority of her industrial plant stolen or destroyed.

The rapidity of her economic recovery has been nothing short of marvellous, says the report, and in many respects the situation is at the present time a great deal better than it would appear to be from a study of mere figures.

Mr. Duke proceeds to review the financial position, from which he concludes that, given a resumption of normal conditions and a reasonable prospect of recovery from Germany—in at any rate the same degree as other claimants—Belgium will be in as sound a financial state as any other European country.

Considering that the war cut off Belgium's export trade and that prior thereto Germany bought (in 1913) 940 million francs' worth of Belgian goods, it will be realised how essential it was to re-establish sales in foreign markets.

Of the many steps taken to attain this end, that which most nearly affects the British engineering industry is probably the commercial mission to South and Central America. This was accompanied by technical experts in the principal branches and equipped to demonstrate by the kinema and other means Belgian manufacturing capacity. Amongst other methods to be adopted for the purpose of enhancing Belgium's competitive power abroad are: the practical training of students of export trade by means of scholarships offered by banking and industrial bodies; the increase of foreign branches of Belgian banks, and the issue of long term credits; the co-ordination of Belgian export and shipping organisations and the development of regular Belgian services to foreign ports; and, lastly, the establishment by the Government of a reliable commercial intelligence service.

After referring to the difficulties in the way of British trade with Belgium, due mainly to the fluctuation in the value of the franc, the Commercial Secretary gives certain reasons why British manufacturers and business men, if they wish to recover their position in the Belgian market, should put themselves to some trouble to understand and appreciate the mentality of their potential clients in Belgium. He points out that there is much in common between the two countries, including the principle of honesty and common sense in business affairs, and there still remains in Belgium a traditional belief in the quality of British goods which has only been slightly obscured by other influences. It is, however, quite certain that, unless prices are considerably reduced, better terms of credit given, more allowance made for exchange difficulties, and greater attention given to punctuality in delivery, British trade with Belgium will continue to diminish, at any rate as regards those articles which are not dependent on their traditional "luxury" character, or are not virtual monopolies of British manufacture.

The following suggestions, adds Mr. Duke, though in some cases hackneyed and in others counsels of perfection, may be worthy of consideration during the next few years:—

1. Catalogues and literature *must* be issued in French, and measurements and prices be quoted in that language.

2. Quotations must be made c.i.f. Belgian port, and, if possible, delivered inland. Continental competitors can deliver their goods from producer to consumer in the same wagon.

3. Reasonable credits must be given to enable the buyers to take the least possible risks on the rate of exchange. Where possible, payment in francs should be accepted; this presents less difficulty in the case of British firms requiring raw materials or accessories from Belgium—a process which in itself tends to encourage trade with Great Britain.

4. The question of payment is obviously greatly facilitated by dealing through an agent in Belgium, who is at the same time a selling agent for Belgian goods. In this connection it is essential to appoint either a Belgian agent or an English one who has been in Belgium for some years and is thoroughly acquainted with the country and its methods of business. The "personal touch" is of the highest importance. The potential buyer in Belgium does not like business by correspondence only; it is not too much to say that he will pay a higher price in nine cases out of ten to an agent who is personally introduced and known to him rather than buy the same goods cheaper by correspondence or from an unknown British traveller.

5. Every possible assistance should be given to Belgian agents in respect of commission and expenses, provision of samples, advertising matter, and the like. Complaints have been numerous on this subject.

6. First-class travellers—if possible members of the firm—should visit Belgium periodically to confer with their agents, be introduced to customers, and demonstrate new developments.

[Mr. Duke has constantly heard of and received visits from travellers for British firms whose ignorance of the country, of the language, even of their own business, can only be described as lamentable.]

7. Although it may seem an unimportant matter, the stamping of correspondence must receive careful attention. Small items, such as the payment by the prospective buyer of double postage on a letter, do not encourage him to do business at a time when a rise or fall in the exchange of 10 centimes per franc may make all the difference between profit and loss.

8. Efforts should be made to quote *firm* and not to make additions to quoted prices on the ground of increased cost of raw material or labour. Generally the buyer or agent will prefer to pay a higher price in the first instance. If an increase is necessary, the fullest possible explanation should be given.

9. In this connection, a great deal of good can be done by "putting the cards on the table," explaining to customers the exact situation of the manufacturer and expressing and showing in practice a desire to help the Belgian customers, whether actual or potential. Personal propaganda of this kind, carried on between the seller and his customers, is far more effective than any general trade propaganda from official sources can be.

10. A great deal can be done by mutual co-operation between British manufacturers and traders. Those who wish to develop their business in Belgium should not fail to become members of the British Chamber of Commerce in Belgium (Secretary, Mr. E. F. Satchell, 2, Rue de la Bourse, Brussels).

As an indirect method of furthering British trade, the report suggests that investment in Belgian enterprises is worthy of consideration. The high rate of exchange has rendered the opportunities of obtaining controlling interests in Belgian industries especially attractive to British manufacturers and capitalists. In many cases advantage has been taken of the situation by British firms, particularly in the engineering and constructional industries. Mr. Duke considers that there are still opportunities of which advantage may be taken, particularly in (*a*) building operations in the devastated areas; (*b*) the development of ports, harbours and canals and the establishment of necessary enterprises such as shipbuilding and repairing; (*c*) electrification schemes; and (*d*) general manufacturing industries, where the comparatively low cost of wages and taxation, coupled with the prospect of excellent transport conditions, may be expected to facilitate cheap production.

The Belgian buyer undoubtedly prefers an article made in Belgium to the same quality of article made in England, and the Belgian Government in particular prefers to deal with Belgian companies, even if they are only so in name.

At the same time British influence in Belgian companies can be used to divert to the United Kingdom their purchases of plant and machinery.

The report devotes a short section to a review of the engineering industry:—

Before the war practically every branch of the engineering industry was established in Belgium. Tremendous damage was done during the occupation, and the high cost and shortage of raw materials put further difficulties in the way of resumption. Many firms have profited by the slackness in trade during 1920 and 1921 to complete the reconstruction of their works damaged by the Germans and to install new equipment. At the same time attention has been given to the importance of making Belgium independent of other countries, and particularly Germany, with regard to electrical material, and during 1919 six new electrical factories were established, manufacturing conduits, switchboards, incandescent lamps, machinery, and signal apparatus.

The "Ateliers de Constructions Electriques de Charleroi," which has a capital of 40,000,000 fr., can now exploit virtually the whole field of electrical construction, thanks to the entirely modern machinery installed, and the extensions made to its works. During 1920 an immense number of orders were received, and the company has consequently been able to tide over the general industrial crisis ruling in 1921.

* Department of Overseas Trade, 3s. 6d.

The Société d'Electricité et de Mécanique Procédés Thomson-Houston et Carels has also extended its works; the machine tool and mounting department has been enlarged, the foundry for small parts has been doubled, and a mechanical foundry installed. Large modelling workshops have been built, and also a warehouse for general purposes. Regulators, alternators, transformers and large motors are now manufactured, while as regards the mechanical construction of Diesel engines and steam engines, it is claimed that production has reached the pre-war figure.

German competition in the electrical constructional industry is, however, growing serious in Belgium, and the Allgemeine Elektricitaets Gesellschaft has opened offices in Charleroi under the mask of a Luxemburg firm. Any sale of British technical goods in this country is exceedingly difficult owing to the high prices quoted.

TRANSMISSION LINE TESTS AT 280,000 VOLTS.

By R. J. C. WOOD.*

Preparatory to converting the two 241-mile Big Creek lines from 150 kV to 220 kV, the Southern California Edison Co. made extensive field investigations to determine the feasibility of using existing towers and standard 10-in. suspension insulators, now used on the lines. In addition field tests were made at voltages as high as 280,000 to ascertain corona loss from conductors under actual operating conditions and different weather and to check the charging current against calculated values.

As a result of these field tests and the laboratory experiments which preceded and paralleled them, it has been decided to equip the insulators with shielding and grading rings and to increase the number of units from nine to eleven. It is believed that satisfactory operation at 220,000 volts will be possible without any other changes.

Owing to the fact that only one bank of high-voltage transformers was available for the field test, it was not possible to transmit power, the lines being merely energised. On September 16th, 1921, a 7-mile section of line was raised to 275 kV, later an additional 5 miles of line was cut in; two weeks later 19¼ miles of line were energised to 280 kV, the reactance of the transformers causing the voltage to increase, together with the charging current of the line. About a month thereafter another 6¼ miles of line was added, and at this time it was determined to lower the voltage to 241 kV to conform more nearly to what will ultimately be the operating voltage of 220 kV.

Before conversion to 280 kV the line was in commercial operation at 150 kV and the insulation consisted of nine 10-in. cap-and-pin suspension units except at anchor towers, where

Suspension Insulator, Showing Shield Rings.

double strings of eleven units each were used. There were arcing horns at the top and bottom of the suspension strings and on the upper side of the dead-end.

For the purpose of the experiments, shield rings were installed at the bottom of all suspension strings and at the top of the centre suspension. With one or two exceptions, the old arcing horns were left at the top of the outer suspensions. The arcing horns at the lower ends of suspension strings were not removed, being within the influence of the shield ring and inert. When necessary to tie down the line shield rings were placed at the top of the tie-down strings. The double-string dead-ends had oval shields attached at the line end; the old arcing horns were left at the tower end.

*Electrical World. Abstract.

The shape and size of the shield rings employed was determined after considerable investigation of the voltage distribution along the insulator strings under different conditions. The arcing characteristics of the shields are good. The deep straight-sided ring, shaped so as to cause arcs to start from its lower edge, produces an electrostatic field of a shape that keeps the arc well away from the insulators. Under wet conditions the arc starts from the ring clear of the lower insulators. The first shield was made of cast iron, but the greater number are of cast aluminum. The practicability of substituting pressed steel has been under consideration.

The 27 miles of experimental line has 291 suspension strings, of which 249 were left with nine insulators and the remaining forty-two strings were increased in length by adding two more insulators to each. There were forty-eight tie-down strings, which had one more insulator than the corresponding suspension string, and 348 double dead-end strings, in which the number of insulators was not changed.

The conductors are steel-core aluminum concentric-strand cables with individual wires 0.1059 in. in diameter, and the diameter of the cable is 0.96 in. The conductors are separated by 17 ft. 3 in., and are arranged in a horizontal plane, the height of conductors above ground at towers being 37 ft. Single-circuit structural-steel towers are used with a normal spacing of 660 ft. The experimental section of the line goes chiefly over hilly country and the spans are of irregular length up to a maximum of 2,871 ft., with an average length of 928 ft.

With 278 kV between conductors, the observed charging currents of 19.5 miles of line were 15.0, 16.1 and 14.6 amp. for the west only, centre and easterly conductors respectively, averaging 15.23 amp. The calculated current is 13.83, using the weighted mean spacing and hyperbolic formula. As shown by an analysis of the voltage wave, harmonics were sufficient to account for an increase in charging current of about 3 per cent., leaving a 7 per cent. increase above the calculated to be explained by the presence of an adjacent line, the overhead ground wire, the increase of capacity due to corona and the presence of the shield rings and line hardware. With 27 miles of line energised at 241.5 kV, the charging currents were 17.3, 18.7 and 17.6 respectively, averaging 17.87. This is 7.5 per cent. greater than the calculated. The current wave is less distorted than when operating at the higher voltage.

Energised at 278 kV to 284 kV and with atmospheric conditions varying from hot and dry to heavy fog, the total loss in the 19¼ miles of circuit ranged from 300 to 880 kW, there being apparently more loss in fog than in rain. One clear morning a test was made energising the line separately from a steam turbo-generator, so that the voltage could be varied at will. The results correspond closely to those calculated by Peek's formula.

There is no measurable corona loss in 27 miles of line at 241 kV in clear weather, the maximum observed so far in rain being 243 kW, or an average of 3 kW per mile per wire. At the proposed operating voltage of 220 kV the losses are negligible.

When energised at 280 kV the line is very noisy and corona is abundant on the cable in the span, but none can be seen on the insulators or shields or on the conductor within a distance of about 3 ft. on either side of the shield ring. At 241 kV there is a very slight noise. At 220 kV operation will not be noticeably different from that at 150 kV. Since the whole 27-mile length of line has been energised at 241 kV, several rainstorms have occurred. No insulator trouble developed.

Shipping and Engineering Exhibition, Olympia, 1923.—Though 1924 has been decided upon as the year for the great British Empire Exhibition at Wembley Park (the electrical and engineering arrangements, for which have already been briefly announced in these pages), it has been resolved that there shall be a Shipping, Engineering and Machinery Exhibition held at Olympia in September next year. The decision was arrived at, we are informed, at a meeting of experts, held on June 1st, at the Holborn Restaurant. Dr. H. S. Hele-Shaw, president of the Institution of Mechanical Engineers, was elected chairman of the Hon. Committee of Experts, with Capt. H. Riall Sankey, C.B., as vice-chairman. We are informed that wide and influential support was given to the movement so that the shipping and engineering industries should be well represented. The hope was expressed that every stall would demonstrate working exhibits and the latest inventions, in order to interest the general public. Every mechanical engineer in the world is to be invited to the exhibition, and bulletins in foreign languages are to be sent to all countries, so that the endeavour may be thoroughly understood and appreciated. Sir Charles A. Parsons, K.C.B., F.R.S., is the president of the shipping exhibition, and among the vice-presidents are the Rt. Hon. Lord Weir, of Eastwood; Sir Archibald Denny, Bart.; Sir E. H. Tennyson D'Eyncourt; Engineer Vice-Admiral Sir George G. Goodwin, K.C.B.; Sir Alex. B. W. Kennedy, LL.D. Sir Archibald Ross, K.B.E., M.Inst.C.E.; and Colonel R. Saxton White. Mr. F. W. Bridges, 4, Vernon Place, W.C.1, is the general manager.

SHORT-WAVE DIRECTIONAL WIRELESS TELEGRAPHY.

By C. S. FRANKLIN.

(*Abstract of paper read before the* Wireless Section of the Institution of Electrical Engineers.)

In this paper are given results of investigations made with reflectors and wave-lengths below 20 metres. The author demonstrated with a continuous-wave valve transmitter made by Mr. Witt, furnishing approximately a 1-metre wave, and a reflector having a 2-wave-length aperture, so that some idea could be got of the order of the directional effect, or "beam," obtained.

The investigation was commenced by Senatore Marconi in Italy in 1916. The author assisted him there, and the waves used were 2 and 3 metres. The only interference experienced with such waves was from motor boats and motor cars. These machines apparently emit waves from near 0 up to about 40 metres in length, and the day may come when they will have to have their ignition systems screened, as on some aeroplanes, or carry a Post Office licence for transmitting. Incidentally, if some of the motorists were to listen to the irregularity of their ignition they would be surprised. A coupled-circuit spark transmitter was developed, the primary having an air condenser and spark in compressed air. The decrement of the waves emitted was judged to be of the order of 0.03. The receiver was a carefully-picked crystal, while the reflectors were made of a number of strips or wires tuned to the wave, arranged on a cylindrical parabola with the aerial at the focus. The transmitting system could be revolved and the effects studied at the receiver. Assuming that the waves leave the reflector as plane waves of uniform intensity, having a width equal to the aperture of the reflector, it is not difficult to calculate the polar curve of radiation in the horizontal plane, which should be obtained from reflectors of various apertures.

The method of measurement at the receiver was the "slide-back" method with a rectifier; two reflectors with apertures of 3½ wave-lengths, one at the transmitter and one at the receiver, increased the working range about three times.

The Italian experiments showed that good directional working could be obtained with reflectors properly proportioned with respect to the wave-length. The attenuation over the sea for the wave-length used was very high. The experiments were continued at Carnarvon in 1917, and brought into prominence a property of wave propagation which is not generally known, and the extent of which is not realised. This is the very rapid increase in the strength of the electric field with height above the ground. The rate of increase appears to be a function of the height divided by the wave-length, and while not very noticeable with wave of several hundred metres, is very marked with waves a few metres in length. It was not possible to ascribe the weakness of signals to any screening or reflections from trees or other objects. Signals steadily increase in strength with height. Accurate measurements were not possible, but the increase of strength of the field at a height of 10 wave-lengths was estimated to be six or seven times. The increase is not always uniform. When both transmitter and receiver are at a low level the range is very dependent on the nature of the intervening country, and is very restricted even over the sea; when, however, both stations are many wave-lengths above the intervening country its nature is of far less importance, and the range is increased many times. These experiments showed that very considerable ranges were possible with very short waves.

In 1919 experiments were commenced at Carnarvon with valve transmitters, with the idea of producing a directional telephone system. A single-valve transmitter was arrived at, taking about 200 watts with a 15-metre wave, and giving 1 ampere in the centre of a half-wave aerial. A heterodyne receiver with supersonic beat-note was employed. Very strong speech was obtained at Holyhead, 20 miles away. The strength was such that shadows produced by small hills and buildings were hardly noticeable, unless the stations were close behind them. A test on the Dublin Steam Packet Co.'s boats running from Kingston to Dublin was made in June, 1920. Speech was received right into Kingstown Harbour, 70 nautical miles from Carnarvon, and the point was proved that there was no rapid diminution of strength after passing the horizon line from Carnarvon.

In February, 1921, from Hendon very good speech was received up to 66 miles, and fair speech in the neighbourhood of Birmingham. A reflector station was then erected at Frankley, near Birmingham, 97 miles from Hendon, and tests were started there in August, 1921. The following are some particulars of the Hendon and Birmingham plant:—

The transmitter consists of two medium-size power valves working in parallel. The power to the valves is usually 700 watts (4,000 volts, 175 mA). The aerial is rather longer than half a wave-length, and has a radiation resistance of the order of 90 ohms. The efficiency, input to valves to aerial power, is between 50 and 60 per cent., and about 300 watts is actually radiated. With reflectors at both ends speech is strong, and of very good quality—usually strong enough to be just audible with a ¼ to ½-ohm shunt across a 60-ohm telephone. With both reflectors down the speech is usually only just audible with no shunt. Average measurements indicate that the energy received when both reflectors are up is about 200 times the energy received when not using the reflectors. Thus to get the same strength without reflectors as with them a 140-kW valve transmitter of the same efficiency would be required. Local measurements of the polar curves taken round the station show that the electric field in front of the station is increased approximately four times by the use of the reflector, and that the same order of increase is obtained during reception; the increase of energy received due to the use of the two reflectors should therefore be $4^2 \times 4^2 = 256$ times.

That a polar curve taken locally round the station is not the same as the polar curve at a distance, and that the directional effect is soon lost, the author does not agree. It is, however, essential that the stations should be in situations free from obstacles which might cause powerful local reflections and distort the field. The polar curve is practically constant at all ranges.

The production of waves of the order of about 12 metres and upwards is quite practicable up to several kilowatts by large power valves, and it is also practicable to operate valves in parallel. With such high frequencies very large currents pass into the grid and anode, and if any attempt was made to push up the power on a bad valve the glass would promptly melt. The cause of the trouble was due to losses in the deposits on the glass, owing to high-frequency currents induced. Such deposits are always produced in valves during exhaustion, and vary considerably. Mr. E. Green discovered that if the electric field in the neighbourhood of the valve was constrained by means of a shield, so that it was at right angles to the deposit on the glass, then this loss disappeared, and a formerly bad valve would give nearly the same efficiency as a good one. It is now therefore possible to use what are practically standard valves, and their life appears to be about the same as for lower frequencies.

Continuous-wave reception is possible on the transmitting aerial while the transmitter is operating. This has been used successfully for duplexing between Hendon and Birmingham, and eliminates all switching. The heterodyne may be either the transmitter, or an independent small heterodyne in the receiver. Both the transmitter and the receiver utilise the same aerial and reflector, and the transmitter can be operated while receiving. There is no reduction in strength while the transmitter is on, but strong currents are induced in all conducting structures and circuits close to the reflector and transmitter, such as the supporting towers and buildings, and every variable contact produces a noise. The elimination of all variable contacts in the neighbourhood of the transmitter has proved a work of some magnitude.

Reflectors, besides giving directional working, and economising power, show an unexpected advantage, which is probably common to all sharply directional systems. Practically no distortion of speech occurs. Wave-lengths of the order of 20 metres are capable of providing point-to-point directional commercial service over very considerable ranges. Such services will be comparatively secret as compared with the usual non-directional type of transmission.

The directional effect obtained with reflectors which are large compared with the wave-length is so good that it was suggested that it would prove very useful for position finding for ships near dangerous points, and trials are being made with a revolving reflector erected on Inchkeith Island. Mr. N. Wells has been superintending this work, very often under strenuous conditions. The general idea is that a transmitter and reflector revolving will act as a kind of wireless lighthouse, so as to give the position to ships during fog when within about 10 miles of the danger point. The reflector makes a complete revolution once every two minutes, and a distinctive signal is sent every half-point of the compass. It was found that this enabled the bearing of the transmitter to be determined within ¼ point of the compass, or within 2.8 degrees.

The best method of giving the direction to a ship by means of such a revolving beam requires consideration. The method being adopted is, the author thinks, the most practical one. When listening to a moderately sharp revolving beam the signals are heard only for a very short time. The exact time of maximum signals is not easy to determine by ear, but the times of starting and vanishing are easy to determine, as the rate of rise and fall of the signals is extremely rapid. The time half-way between these two times gives with great exactness the moment when the beam is pointing to the ship.

The apparatus proposed is of a very reliable nature. The spark transmitters are very robust, and last for years without attention. The receivers are simple valve rectifiers with fixed adjustments except for a "backing off" potentiometer for dealing with powerful signals at close range. The attenuation of these waves over the sea is so strong that a little experience enables distance to be judged by strength of signals, and this can be measured by means of the potentiometer. The only qualification necessary for a person determining the bearing is the ability to read a few Morse signs.

OVERLOAD INVERSE-TIME-LIMIT RELAY WITH A DEFINITE ADJUSTABLE MINIMUM.

FOR the satisfactory protection of a system, such as a transmission line or distributing network, by means of overload relays it is essential to have time discrimination between the various sections, so that an overload on an outlying section shall not cause all the circuit breakers to operate and disconnect the whole system. When inverse-time-limit relays, that is to say, relays which have a time of operation inversely proportional to the intensity of the overload, are employed, time discrimination can be obtained for ordinary overloads up to, say, 200 per cent. of full-load current, but on a short circuit occurring all relays, whatever their time setting, will operate practically instantaneously. In order to overcome this disadvantage a compensated inverse-time-limit relay has been produced by the Metropolitan-Vickers Electrical Co., Ltd.; this relay, called the type "PB," and illustrated in fig. 1, has inverse-time-limit characteristics up to a certain current value, but for higher current values up to short-circuit conditions the relay will operate with a fixed time limit, so that by approximate time settings discrimination can be obtained under all conditions. The time and load current obtained with this relay is shown in fig. 2. Fig. 3 shows the construction of the relay, and figs. 4 and 5 the external and internal connections.

FIG. 1.—3-POLE RELAY—GENERAL VIEW.

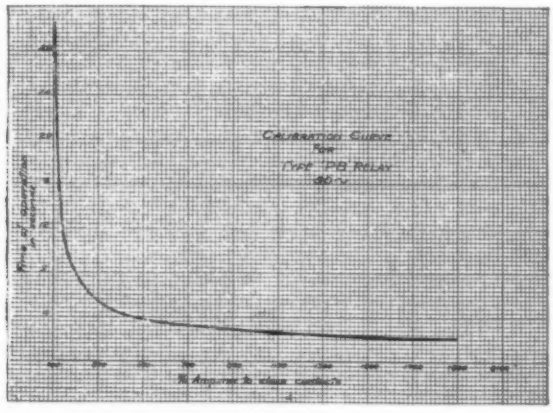


FIG. 2.—CHARACTERISTIC TIME AND LOAD CURVE.

The relay is of the induction type, and is operated by current only. The movement consists of an aluminium disk (1) pivoted so that it rotates between the poles of two electromagnets. The upper electromagnet (2) has two windings, one of which is connected to the secondary of the compensating transformer (4) and the other to the coil on the lower electromagnet (3). The primary of the "compensator" is wound in sections, which are connected through a selection block (8) by a plug (7) to the secondary of a current transformer in the line to be protected. The upper electro-magnet by acting as a transformer itself energises the windings on the lower electro-magnet. The fluxes produced by the two electromagnets being out of phase cause the disk to rotate. The speed of rotation is made proportional to the driving force by the braking action of the permanent magnet (12), and the disk is specially shaped to give a changing torque corresponding to the opposition of the "set up" spiral spring (13). An arm (10) clamped to the rotor spindle carries a pair of contacts which by rotation of the disk bridge the two fixed contacts (11), completing the trip circuit. At the top of the rotor spindle is a pin (5) which, when the relay is not operating, rests against the stop (6) fixed to the adjustable milled-edge time-scale plate (9). Turning this plate alters the position of the stop (6) and increases or decreases the distance to be travelled by the moving contacts, thus varying the time of operation for a given setting.

The compensating transformer (4) is so designed that its core becomes magnetically saturated when the current in its primary winding exceeds a certain value, with the result that a further increase in primary current does not produce a corresponding increase in secondary current, and, therefore, the relay operating torque does not become greater. The effect of this is seen in figs. 2 and 6, the curves showing the definite minimum time of operation of the relay under extremely heavy loads. For calibration purposes a "swamp" resistance is used in parallel with the coil on the lower electromagnet (3).

The above description of the internal windings applies to relays for 50 periods and upwards, the arrangement of the coils being different for 25-period circuits.

The current settings provided are for 85 per cent., 100 per cent., 125 per cent., 150 per cent., and 175 per cent. of full-load current of the line transformer, and these are obtained by inserting the plug (6) in the correspondingly marked holes in the selection block (8).

The time-scale plate (9) already referred to has two scales; one is 0 to 30 seconds in black, and the other 0 to 2 seconds in red. By adjustment of this scale plate the desired time setting can be obtained, it being noted that the definite minimum corresponding to 30 seconds is 2 seconds, and in proportion for other settings; thus discrimination by 1/5-second intervals has been obtained with 10 relays in series.

Fig. 6 shows four time settings for any current setting, and clearly illustrates the definite minimum times obtainable

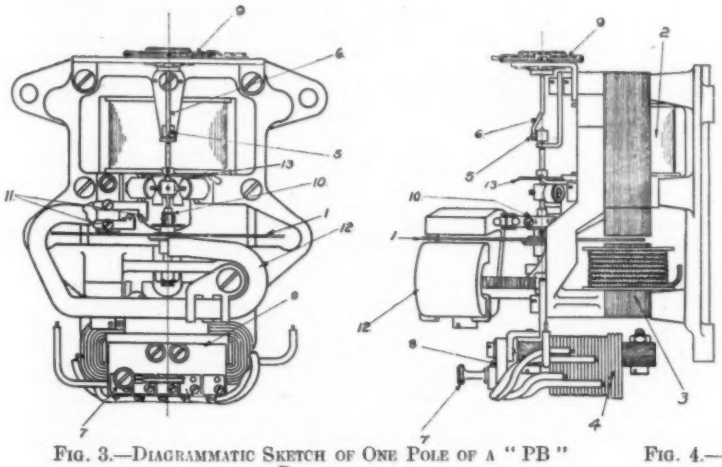


FIG. 3.—DIAGRAMMATIC SKETCH OF ONE POLE OF A "PB" RELAY.

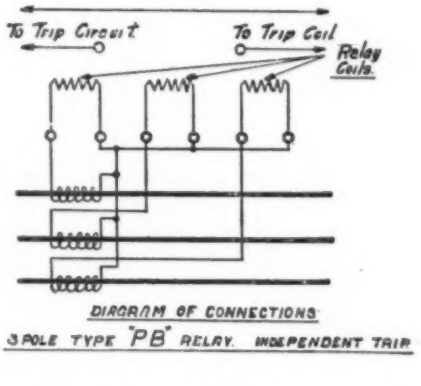


FIG. 4.—DIAGRAM OF EXTERNAL CONNECTIONS OF A 3-POLE RELAY.

with different time settings, the discrimination in this example being 0.5-second intervals with approximately twenty times the setting current. These curves are drawn with "percentage amperes to close contacts" as abscissæ, and "time of operation" to a logarithmic type of scale as ordinates, to accentuate their shape and render their characteristics more easily visible.

Each relay of this type is fitted with a plate on which is drawn its characteristic curve, as determined by calibration.

Discrimination and minimum time would still be maintained, even with loads in excess of the twenty-fold current shown on the scale, as the natural droop in the ratio curve of the line current transformer would assist the relay. The minimum time can, if desired, be considerably increased by the use of a stronger brake magnet.

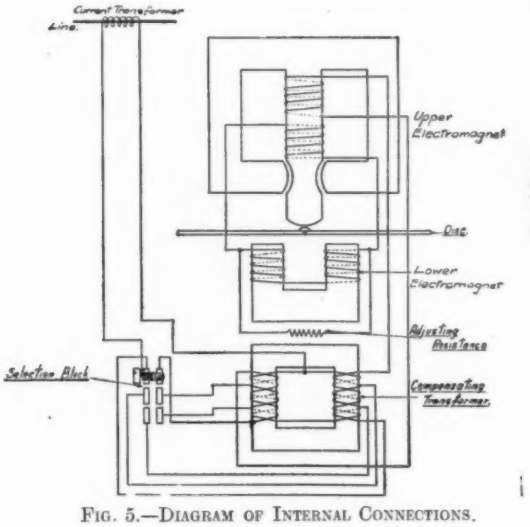


FIG. 5.—DIAGRAM OF INTERNAL CONNECTIONS.

Fig. 4 shows the external connections of a 3-pole type "PB" relay arranged for independent tripping.

This type of relay is manufactured in single, two- and 3-pole patterns.

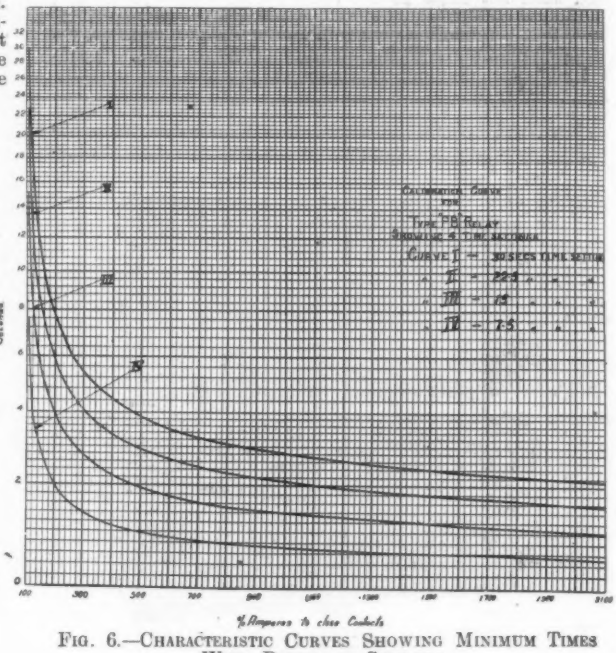


FIG. 6.—CHARACTERISTIC CURVES SHOWING MINIMUM TIMES WITH DIFFERENT SETTINGS.

THE VIEW PARK COLLIERY EXPLOSION.

OFFICIAL INQUIRY.

AN outstanding feature of the inquiry into the circumstances attending the explosion at View Park Colliery, Uddingston, was the large number of witnesses who were warned that they need not answer, unless they liked, questions which they thought might involve them in criminal proceedings, and seven witnesses who had a more or less intimate connection with the actual operations prior to the accident were warned in the Hamilton Sheriff Court. Great interest was taken in the inquiry, and it was stated by Mr. John Masterton, the Chief Inspector of Mines for the Scottish District, that it was the most important which had ever been held in Lanarkshire.

Sheriff Shennan, who presided, explained at the outset that the inquiry had reference to the deaths of Andrew Masters and John Chalmers, miners, Uddingston, who were fatally injured in a colliery explosion. At the inquiry, Mr. John Masterton, Chief Inspector of Mines for Scotland, represented the Home Office: Mr. R. Ferguson, writer, Glasgow, appeared for the employers, while Mr. Robert Smillie, president of the Lanarkshire Miners' Union, and Mr. J. C. Allan, solicitor, Hamilton, watched the proceedings on behalf of the relatives of the deceased.

Bernard Finnegan, colliery machineman, stated that on April 11th he was working with Joseph Lynch at an electric coal cutting machine in No. 1 pit, View Park Colliery. He had just switched on when the explosion occurred, and the flame travelled from Lynch past him. He switched off the current and was injured in doing so. He did not notice any flame shooting out of the switch-box of the machine.

Cross-examined by Mr. Masterton.—When his neighbour and he went on duty that night they saw their switch box was all right. He did not know exactly whether all the bolts and screws belonging to the box were in at the time of the accident. It was quite possible bolts would be missing and witness would not know. It had always been the case that bolts had been missing, as far as he could understand.

By Mr. Smillie.—The machine had been overhauled by the electrician at the week-end prior to the accident. He had seen the machine "flashing," but not on this occasion.

By Mr. Ferguson.—They had several times reported the presence of "flashing," and had got their switch put right for that. On this particular night he saw nothing of that kind. It was not the case that, prior to the explosion, witness and his mate had been instructed by the manager to use an oil safety lamp in addition to the electric lamp.

Joseph Lynch, the leading machineman, deposed that the machine had been sticking and not working well before the explosion. He denied, however, that there had been any "flashing" with the coal-cutter. There were little holes in the machine caused by studs being awanting. As the absence of these studs did not do any harm to the machine, he had made no complaint. Because of the fact that studs were awanting, one could see inside the coal-cutter and detect the electric flashes. If there was gas in the place it might go in there and cause an explosion.

Cross-examined by Mr. Smillie, witness said it was well known that this was a gassy district.

By Mr. Ferguson.—He did not do any adjustment to this machine while he was working with it. He did not report to the electrician that bolts were missing, because he thought that would be seen.

A number of miners who were subsequently called as witnesses described the explosion.

Frederick Boles, the night shift foreman in the colliery, said that he found gas where this explosion occurred on April 2nd, 3rd and 4th. On April 5th, the place was reported clear, but gas was found on April 6th, 7th, 8th, and 9th. During the shift beginning on the evening of the 10th and up to the time of the explosion he found no gas. Never at any time had he occasion to withdraw men from the workings.

Replying to Mr. Smillie, miners' agent, witness maintained that the gas he found was not in any dangerous quantity.

George Thom, the electrician at the colliery, explained that he had charge of the electrical appliances in the area where the explosion took place. On the day before the accident he had entered in the log book that the electrical apparatus was in good condition. The electrical coal cutter used in the section at the time of the explosion was put into a satisfactory condition at the week end before the accident. It was used for the first time on the Sunday, and on the Monday morning there was complaint about the bushes. Witness saw the coal cutter after the accident, and there was a difference in it, studs being out. Ten bolts and studs were missing. The absence of these meant that the machine casing would not be explosion proof. He could not say what caused the explosion. Quite a possible cause, however, was gas being ignited through lack of the bolts and studs. Witness was present at the Rosehall Collieries when the machine was tested subsequent to the accident. It worked satisfactorily then with the bolts and studs in position. With these parts out, gas was ignited, but when they were in, the machine was explosion proof.

By Mr. Smillie.—Witness was chief electrician at the

colliery and there was a staff of seven or eight altogether attending to the electrical apparatus. If the men who worked the machine said these bolts and studs had not been in for months, he did not think that would be a true statement.

The jury returned an open verdict, adding that the evidence did not warrant a finding on the question of negligence.

PARLIAMENTARY NOTES.

(FROM OUR SPECIAL PARLIAMENTARY REPORTER.)

Parliament adjourned for the Whitsuntide Recess, and will reassemble on Monday next, June 12th.

Telephone Service.—On May 30th, Sir H. Brittain asked the Postmaster-General whether he realised that many telephone subscribers were sceptical as to the record of calls accredited to them at their respective exchanges, and whether he was able to report to the House the opinion of the Post Office as to the possibility of installing in the near future in each exchange an effective automatic recorder. Mr. Pike Pease said that complaints of over-charging were diminishing as subscribers, formerly on the unlimited service rate, realised the extent of their use of the telephone. No satisfactory automatic recorder had yet been devised, either in this country or abroad. Sir H. Brittain asked whether the Post Office ever thought of offering a reward for a satisfactory automatic recorder. It might encourage inventors. Mr. Pike Pease replied that he had seen such an apparatus as that referred to, but it was not considered satisfactory for the Post Office. He would note what had been said with regard to offering a prize.

Post Office (Pneumatic Tubes Acquisition).—In Committee of Supply on May 30th, the House of Commons authorised the expenditure of £11,200 "to confirm an agreement between the Pneumatic Despatch Co., Ltd., and the Postmaster-General in relation to the acquisition of a certain tube running between St. Martin's-le-Grand, in the City of London, and Eversholt Street, in the Metropolitan borough of St. Pancras, and for purposes connected therewith."

Import Duties.—On May 29th Dr. Murray asked the President of the Board of Trade whether the terms of reference of the Optical and Scientific Instrument Committee, appointed by him under the Safeguarding of Industries Act, included calculating apparatus, cylinders and slide rules, also electrical goods and instruments, ammeters, voltmeters, &c., seeing that the total imports from all countries for six months only amounted to £5,239; and, if not, if he would, in appointing further committees, clearly state what their terms of reference included, and thus avoid the labour and expense involved in the preparing of statements and the bringing of witnesses, often from a long distance, before the committee, to state that there was no justification for the making of an order.

Mr. FOOT asked whether he was aware that, under the title of optical and scientific instruments and optical elements, over 1,000 different articles were embraced, and that it was stated before the committee who were considering the application for the imposing of an additional 33⅓ per cent. duty upon these goods, that it was not necessary to consider each article, but only one or two, as the recommendation in regard to these would apply to all others; and whether he would say if this proposal had received his sanction.

Mr. BALDWIN replied that the terms of reference to the Committee covered optical elements and optical and other scientific instruments, and the Committee were directed to report whether the conditions laid down in the Act were fulfilled with regard to all or any particular varieties of such articles. The Committee would, no doubt, exercise their discretion as to how far they should require separate evidence in regard to any particular variety of instruments concerned; they would also, no doubt, bear in mind their terms of reference in deciding whether or not to admit evidence in regard to any particular class of article. The import figures quoted were quite inaccurate, as they were not the value of the goods but the amount of duty collected thereon.

Private Bills.—The Ayr Burgh (Electricity) Bill and the Torquay Corporation (Electricity) Bill have been read a first time in the House of Commons, and have been referred to the Examiners of Petitions for private bills. The Grampian Electricity Supply Bill has been read a first time in the House of Lords.

Royal Assent.—The Royal Assent has been given to the following Bills: Yorkshire Electric Power Bill; Ayr Burgh (Tramways, &c.) Order Confirmation Bill; Metropolitan Railway Bill; and the City of London (Various Powers) Bill.

Wireless Licences.—On May 30th Mr. Kennedy asked the Postmaster-General whether the temporary permission which was granted to the Marconi Co. to conduct a wireless telegraph service between London and Paris had been confirmed by the grant of a permanent licence; and whether, having regard to the prejudicial effect of the Marconi Co.'s service upon the State cable service and to the appreciable loss of revenue, he would, in accordance with his promise, cause the agreement to be laid before Parliament at the earliest possible moment.

Mr. PIKE PEASE (Assistant Postmaster-General), said that no formal licence had yet been issued. The question of the conditions under which a permanent licence should be granted was still the subject of negotiation. In the event of an agreement beinf reached its terms would be laid before Parliament in accordance with the promise given. The Marconi Co.'s service had probably withdrawn a certain amount of traffic from the cable service, but the loss of revenue involved was not appreciable.

Electricity and Water Charges.—On May 30th Captain Reginald Terrell asked the Minister of Health whether his attention had been called to the continued high charges for essential services, as water, gas, and electricity, all over the country; and what, if any, steps he proposed to take to bring about a general decrease in such charges.

SIR A. MOND said that his department dealt only with water charges. These charges were generally limited by Statute, and he was not aware that they were generally excessive.

LEGAL.

CHARLES SEMON & CO., LTD., *v.* BRADFORD CORPORATION.

IN the Chancery Division on June 2nd, Mr. Justice Eve delivered judgment in this case which has been reported in the ELECTRICAL REVIEW.

His LORDSHIP said the plaintiffs were merchants engaged in the dress goods trade, and owners in fee of a building at the junction of Bolton Road and Balme Street, in the centre of the City of Bradford. On the Balme Street frontage facing northwards, the warehouse had 36 windows, six on each floor. The building was exceptionally well lighted, and above the average of smaller buildings used for like businesses in Bradford. The access of light had been practically unimpeded inasmuch as there had never been any obstruction higher than a hoarding around the vacant space on which the Corporation contemplated building an electrical station to a height of 73 feet from the street level. Plaintiffs said this building would, if erected, so diminish the access of light to the ground, first and second floors, as to detract from the beneficial use and occupation of their warehouse. The width of Balme Street was 45 feet, and the proposed building would be practically co-terminous with the warehouse. He only proposed to deal with four of the windows on the easterly side of plaintiffs' building, for as to the remainder, he thought the evidence was such that no reasonable man could say that the proposed building would seriously interfere with the light of them. Having heard the evidence on both sides he had come to the conclusion that it was impossible for him to hold that the plaintiffs had established the burden that the defendants' electrical station would be an actionable nuisance. The plaintiffs would, when it was completed, have an unusual amount of light. Under those circumstances he could only dismiss the action with costs.

The Water-Heating Load.—As it seems probable that the continuous or "100 per cent." load of the future will lie in the direction of water heating, it is of interest to note the views of a water-heating expert, Mr. J. A. McDonald, recently expounded in the Canadian *Electrical News*. Mr. McDonald says that owing to the long periods in which hot water is not required, the question of time is not of importance; the main consideration is the most suitable loading to give the required amounts of hot water at the proper times. In Canada the majority of domestic boilers have a capacity of from 30 to 40 gallons. In the case of 30-gallon boilers it has been found desirable to have an element of 700 W, but in special cases 600 W may be satisfactory; where excessive amounts of hot water are required 1,000 W should be used. The last loading is quite suitable for the ordinary purposes of a 40-gallon boiler. The writer analysed the performance of a 700-W element in a 30-gallon boiler as follows:—The element was started up in water at 46 deg. F., in the evening, and at 7 a.m. the following morning the temperature of the water was 155 deg. Twenty gallons was then withdrawn and the temperature fell to 85 deg., rising by 1 p.m. to 115 deg., when 18 gallons was drawn off. This caused a drop to 77 deg., which rose to 108 deg. by 5 p.m., when a further 20 gallons was required. With a 1,000-W element the curve was similar, but the fall of temperature upon the withdrawal of water was not so great. Heaters and boilers of the capacity described are giving satisfactory service, and the careful measurement of domestic requirements shows that the demands made in the tests are rarely, if ever, reached.

"Safety First" in X-ray Work.—A small booklet has been issued by Messrs. Watson & Sons (Electro-Medical), Ltd., in which the recommendations of the X-Ray and Radium Protection Committee, regarding the securing of safety to operators, are set out. A N.P.L. report on a "safe" installation is also included.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEXTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

14,043. "Transmission of messages through cables having a high electrostatic capacity." C. J. Coleman. May 18th.
14,049. "Electric ignition devices for oil fuel in boiler furnaces." E. G. F. Swangren. May 18th.
14,050. "Operating-gear for electric switches, &c." H. Fawcett and Metropolitan-Vickers Electrical Co., Ltd. May 18th.
14,053. "Electric accumulator batteries." Soc. des Accumulateurs Electriques Anciens Etablissements A. Dinin. May 18th. (France, July 6th, 1921.)
14,059. "Electric accumulators, &c." H. Leitner. May 18th.
14,061. "Sparking plugs." C. W. Coventry. May 18th.
14,064. "Insulators." Brecknell, Munro & Rogers, Ltd., and A. M. Willis. May 18th.
14,080. "Ignition apparatus for internal-combustion engines." B. Hopps and A. M. Lodge. May 18th.
14,083. "Electric starting switches." E. Schattner. May 18th.
14,088. "Electric-control gear." Clarke, Chapman & Co., Ltd., and R. C. Harris. May 18th.
14,098. "Sparking plug tester." C. H. Mitchell. May 19th.
14,120. "Electric melting furnaces." W. Travis. May 19th.
14,121. "Attachment of picture-projecting apparatus to electric hand lamps, &c." W. K. Wilson. May 19th.
14,141. "Wet battery for wireless apparatus, medical, &c., use." E. J. Prockter. May 19th.
14,147. "Illuminated indicating devices." E. T. R. Murray and L. E. R. Murray. May 19th.
14,182. "Manufacture of thermionic valves, &c." S. G. Frost. May 19th.
14,189. "Electric primers and vent-sealing tubes." F. J. L. Johnson, O. D. Lucas, and V. M. L. Experimental, Ltd. May 19th.
14,190. "Electric relays." F. Allendorff. May 19th.
14,193. "Signalling systems." British Thomson-Houston Co., Ltd. May 19th. (United States, May 20th, 1921.)
14,196. "Utilising parts of gramophone, &c., for wireless, &c., telephony or telegraphy." A. M. Keays and F. Paton-Moore. May 19th.
14,198. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. May 19th. (United States, May 25th, 1921.)
14,203. "Electric horns." H. W. F. Ireland and O. Lucas. May 19th.
14,204. "Jointing or connecting devices for electric cables, &c." G. Ellison. May 19th.
14,205. "Oil-insulated electric switchgear, &c." J. Anderson and G. Ellison. May 19th.
14,210. "Electric outlet and fixture support." Benjamin Electric, Ltd. May 19th. (United States, May 20th, 1921.)
14,211. "Electric outlet and fixture support." Benjamin Electric, Ltd. May 19th. (United States, June 23rd, 1921.)
14,212. "Electric outlet and fixture support." Benjamin Electric, Ltd. May 19th. (United States, August 22nd, 1921.)
14,215. "Automatic mechanism for actuating signals, switches, crossing-gates, &c., from railway trains." C. S. Smith. May 19th.
14,219. "Undertrucks for tramcars, &c." G. N. Cadbury, Electro-Mechanical Brake Co., Ltd., and E. M. Taunton. May 19th.
14,224. "Arrangements for multiplying frequency of alternating current." Ges. für Drahtlose Telegraphie. May 19th. (Germany, May 30th, 1921.)
14,225. "Transmitting antenna systems for wireless telegraphy, &c." Ges. für Drahtlose Telegraphie. May 19th. (Germany, May 27th, 1921.)
14,226. "Reception of wireless signals." Ges. für Drahtlose Telegraphie. May 19th. (Germany, May 27th, 1921.)
14,234. "Electric accumulators, &c." H. E. Foard. May 20th.
14,283. "Apparatus for electrically heating water." L. A. H. Davis. May 20th.
14,298. "Electric measuring instruments." D. Macadie. May 20th.
14,299. "Variable-current generators." British Thomson-Houston Co., Ltd. May 20th. (United States, May 20th, 1921.)
14,300. "Sound-producing devices." British Thomson-Houston Co., Ltd., and A. P. Young. May 20th.
14,321. "Electric circuit fittings." G. D. Brooks. May 20th.
14,328. "Insulation of electric conductors." Berrite, Ltd., and F. Fernie. May 20th.
14,330. "Telephones, phonographs, &c." A. S. Bewley. May 20th.
14,352. "Electric motor." J. Tovopoulos. May 22nd.
14,354. "Electric switches." H. E. Sutherland, W. Walker and W. Preston. May 22nd.
14,355/6. "Electric switches." H. E. Sutherland and W. Preston. May 22nd.
14,369. "Starter transmission gears with automatic switch and dashboard indicator." J. B. Bignamy. May 22nd.
14,385. "Switches for electric horns, &c." A. H. Clark. May 22nd.
14,390. "Electrically controlled illuminated signs, &c." F. W. Williams. May 22nd.
14,400. "Duplex electric motor and control system therefor." Western Electric Co., Ltd. (Western Electric Co. Inc.). May 22nd.
14,426. "Fusible cut-outs for electrically heated articles." C. E. Iredell. May 22nd.
14,428. "Electric furnaces." E. P. Barfield and L. W. Wild. May 22nd.
14,449. "Gas or electric heating apparatus convertible into cooking apparatus." A. G. Mill. May 23rd.
14,452. "Telephone circuits." T. G. Anderson and G. H. Huntsworth. May 23rd.
14,455. "Terminal boxes for high voltage cables." Forges et Ateliers de Constructions Electriques de Jeumont. May 23rd. (France, March 28th.)
14,460. "Electric fan." B. Schmelzer. May 23rd.
14,462. "Electric speed indicating devices." L. E. Taylor. May 23rd.
14,469. "Means for testing filaments of electric lamp bulbs." H. Furse and J. B. Lovatt. May 23rd.
14,489. "Starting and controlling apparatus for electric motors." C. C. Garrard, A. H. Railing and W. Wilson. May 23rd.
14,494. "Wave length, &c., indicators for wireless telegraphy, &c." H. P. Rees. May 23rd.
14,497. "Tramcar." G. F. Slemon. May 23rd.
14,502. "Resistance coils, &c." I. S. Dalgleish and E. Schattner. May 23rd.
14,513. "Loaded signalling conductors." Western Electric Co., Ltd. May 23rd. (United States, August 16th, 1921.)
14,516. "Magneto electric machines." H. W. F. Ireland and H. Lucas. May 23rd.
14,518. "Adjustable sensitive electric regulating device." W. H. Apthorpe and Cambridge & Paul Instrument Co., Ltd. May 23rd.
14,520. "Metal vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. May 23rd. (Switzerland, June 11th, 1921.)
14,530. "Electro-magnetically controlled switching apparatus." F. G. Creed and Creed & Co., Ltd. May 23rd.
14,534. "Timing device for telephones, &c." P. Lonsdale. May 23rd.
14,600. "Relay for telegraphy." E. E. Moore. May 24th.
14,611. "Automatic electric circuit breakers." R. A. R. Bolton and English Electric Co., Ltd. May 24th.
14,622. "Insulated electric conductors." H. C. Braun. May 24th.
14,625. "Electric condensers of continuously variable capacity." A. C. Huskinson. May 24th.
14,627. "Establishing electric connection between movable contacts." Everched & Vignoles, Ltd., and J. C. Needham. May 24th.
14,648. "Electric torches." Ever-Ready Co. (Great Britain), Ltd., and M. Goodfellow. May 24th.
14,658. "Electric time fuse and process for manufacture thereof." W. Eschbach. May 24th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

30,605. "Microphones." J. Gardner. October 29th, 1920. (179,566.)
31,376. "Electron discharge devices especially for use in wireless communication." J. Scott-Taggart. November 5th, 1920. (Addition to 166,260.) (179,568.)
32,570. "Cable telegraphy." E. Potter (F. E. Pernot and L. J. Rich). November 18th, 1920. (179,574.)

1921.

603. "Electric switches." R. K. Mason. July 8th, 1919. (156,632.)
638. "Wireless antenna systems." Ges. für Drahtlose Telegraphie. October 11th, 1919. (156,654.)
795. "Suction sweepers." Apex Electrical Manufacturing Co. July 9th, 1915. (156,734.)
798. "Vacuum cleaning devices." Apex Electrical Manufacturing Co. November 25th, 1916. (156,737.)
880. "Electrical transmission arrangements, especially applicable for motor vehicles." J. A. Stevens and Sankey & Sons, Ltd. January 7th, 1921. (179,584.)
1,458. "Method and device for testing materials." Signal Ges. September 4th, 1919. (157,755.)
1,581. "Ignition in internal-combustion engines." P. Schmidt. January 10th, 1921. (Convention date not granted.) (158,235.)
1,899. "Apparatus for filing the surface of tramway rails and the like." C. Oxley. January 12th, 1921. (179,587.)
3,685. "Electric furnace regulators." British Thomson-Houston Co., Ltd. (General Electric Co.). January 31st, 1921. (179,595.)
3,909. "Telephone repeaters." Western Electric Co., Ltd. (Western Electric Co. Inc.). February 2nd, 1921. (179,600.)
3,916. "Switching arrangements for secondary battery systems." A. H. Cornish, H. S. Saunders, and Petters, Ltd. February 2nd, 1921. (179,601.)
4,119. "Electrical transformers and methods of forming the coils thereof." O. Y. Imray (Executor of O. Imray, deceased) (Pittsburg Transformer Co.). February 3rd, 1921. (179,609.)
4,181. "Electric arc welding systems and apparatus therefor." British Thomson-Houston Co., Ltd. (General Electric Co.). February 4th, 1921. (179,613.)
4,233. "Sparking plugs." G. T. Wilson. February 5th, 1921. (179,617.)
4,475. "Locking devices for electric incandescent lamps." C. Dunglinson. February 8th, 1921. (179,641.)
4,516. "Rotors for electric generators." A. B. Field, S. Neville, and Metropolitan-Vickers Electrical Co., Ltd. February 8th, 1921. (179,647.)
4,536. "Wireless telephone transmitters." Ges. für Drahtlose Telegraphie. February 9th, 1920. (Patent of addition not granted.) (158,901.)
4,588. "Electric cable junction boxes." S. D. White, T. Taylor and F. H. Morris. February 9th, 1921. (179,650.)
4,753. "Electric switch gear." A. Reyrolle & Co., H. W. Clothier and F. N. Linstow. February 10th, 1921. (179,657.)
5,015. "Reduction of interference in wireless telegraphy and telephony." L. G. Preston, H. Morris-Airey and G. Shearing. February 12th, 1921. (179,670.)
5,112. "Electrolytic methods of depositing metals and apparatus therefor." British Thomson-Houston Co., Ltd. (General Electric Co.). February 14th, 1921. (179,675.)
5,206. "Alternating current relay." Dr. F. B. Dehn (Takamine Commercial Corporation). February 15th, 1921. (179,677.)
5,259. "Concentric electric cables." A. M. Taylor. February 16th, 1921. (Patent of addition not granted.) (179,679.)
5,713. "Trolley wheels for the poles of electric tramcars and such like." E. Nightingale and E. Nightingale. October 28th, 1921. (179,698.)
6,013. "Thermal ammeters." Weston Electrical Instrument Co. March 24th, 1920. (Addition to 109,046.) (160,763.)
6,329. "Tapes for insulating the cores of multicore electric cables." H. R. Williams. February 25th, 1921. (179,717.)
6,548. "Electric switches." J. B. Tucker. February 28th, 1921. (179,722.)
6,840. "Electric starters and cut-outs used in connection with electric lighting plant employing combustion engines." A. H. Railing, C. C. Garrard and W. Wilson. March 2nd, 1921. (Addition to 163,111.) (179,725.)
7,124. "Sparking plugs." B. Scherer. March 4th, 1921. (179,727.)
7,684. "Telephone transmission systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). March 10th, 1921. (Addition to 18,018/13.) (179,736.)
7,947. "Electric fuse boards." J. B. Tucker. March 14th, 1921. (179,742.)
8,049. "Electrical starting and energy generating machines, particularly suitable for automobile vehicles." R. Bosch Akt. Ges. November 29th, 1920. (172,274.)
8,765. "Guide pulleys or sheaves for cable haulage systems." S. E. Williams. March 22nd, 1921. (179,759.)
8,862. "Dynamo-electric machines." Sachsenwerk Licht und Kraft Akt. Ges. March 22nd, 1920. (160,734.)
9,147. "Flexible couplings for shafts." K. Baumann and Metropolitan-Vickers Electrical Co., Ltd. March 24th, 1921. (179,769.)
9,242. "Electrical distribution fuse boards, fuse boxes, and the like." Midland Electric Manufacturing Co., Ltd., W. G. H. Cox, and H. E. Sutherland. March 29th, 1921. (179,771.)
9,368. "Fusible electric cut-outs." L. Bartmann. March 29th, 1921. (179,773.)
9,984. "Railway signalling devices." Ateliers de Constructions Electriques de Charleroi (Soc. Anon). January 3rd, 1921. (173,729.)
10,183. "Insulated electric conductors." British Thomson-Houston Co., Ltd. (General Electric Co.). April 6th, 1921. (179,779.)
11,128. "Electric safety fuses." A. L. Eustice. April 16th, 1921. (179,792.
11,236. "Galvanic batteries." G. Oldham and J. Oldham. April 18th, 1921. (179,793.)
12,923. "Construction of electric switches." R. A. R. Bolton. May 5th, 1921. (179,815.)
13,349. "Electrical distribution in alternating current systems." A. M. Taylor. February 7th, 1921. (179,824.)
13,350. "Electrical distribution in alternating current systems." A. M. Taylor. February 9th, 1921. (179,825.)
13,604. "Electric relays." General Railway Signal Co. July 19th, 1920. (166,879.)
14,545. "Frequency multipliers for alternating electric currents." P. Trichard. May 26th, 1920. (Addition to 160,179.) (163,716.)
17,365. "Electrical conductors." W. P. Granville. June 24th, 1921. (179,848.)
18,044. "Process of and apparatus for treating light rays, cathode rays, Röntgen rays, or the like." R. Bengough. September 13th, 1921. (Convention date not granted.) (165,790.)
24,247. "Spark plug valves for petroleum and crude oil engines." Bolinders Mekaniska Verkstads Aktiebolag, J. & C. G. September 29th, 1920. (169,693.)
25,711. "Electro-magnetic relays." Automatic Telephone Manufacturing Co., Ltd. October 1st, 1920. (169,711.)
27,049. "Electric insulators." E. Haefely et Cie. Akt. Ges. November 6th, 1920. (171,368.)
30,087. "Dynamo-electric generators." J. Neyret. March 3rd, 1920. (Divided application on 159,830.) (171,401.)
31,095. "Telephone instruments." Automatic Telephone Manufacturing Co., Ltd. December 7th, 1920. (172,616.)

1922.

475. "Automatic electrical sub-stations." Metropolitan-Vickers Electrical Co., Ltd. March 14th, 1921. (177,141.)
8,249. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). February 2nd, 1921. (Divided application on 3,928/21.) (179,882.)